WATER & SEWAGE WORKS

SEWAGE TREATMENT WORKS OF PEORIA, ILLINOIS

ADVANTAGES OF PRESTRESSED CONCRETE CYLINDER PIPE • NO. 4

Maximum use of local labor and materials...

• The installation of Prestressed Concrete Cylinder Pipe offers no exception to the Lock Joint Pipe Company's general practice of setting up temporary manufacturing plants near the location of projects—and using a maximum of local labor and local materials.

All necessary equipment for the manufacture of this high head pipe is transported to the temporary plant where the cylinder is fabricated, tested and lined with a substantial thickness of concrete. After a proper curing period, the lined cylinder is tension wrapped with high tensile wire and protected from corrosion, by a mortar coating.

Experience on major installations in various parts of the country has proven that Lock Joint Prestressed Concrete Cylinder Pipe offers many important advantages — higher pressures in a greater range of sizes, increased elasticity, minimum weight, excellent performance and maximum water-tightness. You can profit by this experience if you consult us on all your pipeline problems.

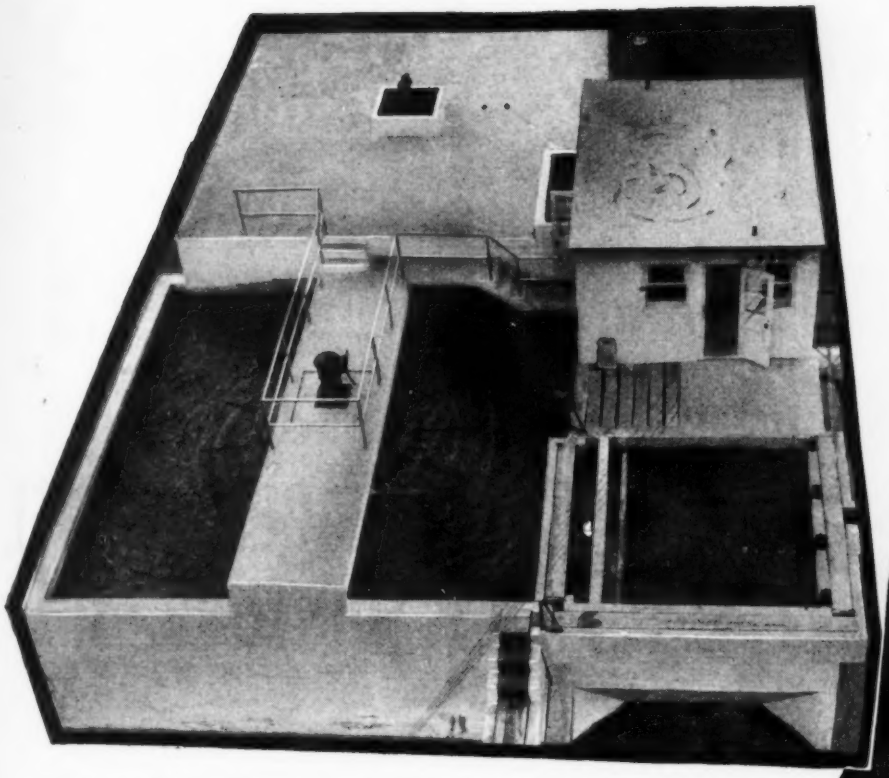
A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY
Established 1905
P. O. BOX 269, EAST ORANGE, NEW JERSEY
Denver, Colo. · Chicago, Ill. · Kenilworth, N. J. · Kansas City, Mo. · Rock Island, Ill.
Joplin, Mo. · Valley Park, Mo. · Cleveland, Ohio · Hartford, Conn. · Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

WATER AND SEWAGE WORKS, March, 1947. Volume 94, Number 3. Published monthly by Gillette Publishing Co., 22 West Maple St., Chicago 10, Ill. Per copy, 25c. Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.



Chicago "Package" Sewage Treatment Plant at the Eastern Air Lines Terminal, Miami, Fla. The primary tank is in the right foreground. Behind it is the pump house. Left foreground is the Combination Aerator-Clarifier. Aeration and clarification are performed in this single tank. Behind it is the digester.

CHICAGO "PACKAGE" SEWAGE PLANTS

OVER 100 IN SUCCESSFUL OPERATION LAST 12 YEARS

COMPLETE . . . CONSISTENT . . . NUISANCE-FREE SEWAGE TREATMENT FOR SMALL COMMUNITIES

Tailored to requirements • Low first cost • Simple to operate by local man • Located close to residences without odor or fly nuisance • Neat in appearance • Space saving • Consistent sparkling clear effluent.

Complete engineering data furnished Consultants so they can apply "Package" Plants to any small community, housing project, institution, airport or industrial plant.

NOTABLE, EXCLUSIVE CONTRIBUTIONS TO SEWAGE TREATMENT

"PACKAGE" PLANTS
SWING DIFFUSERS
COMMINUTORS
FLUSH-KLEENS
SCRU-PELLERS

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers,

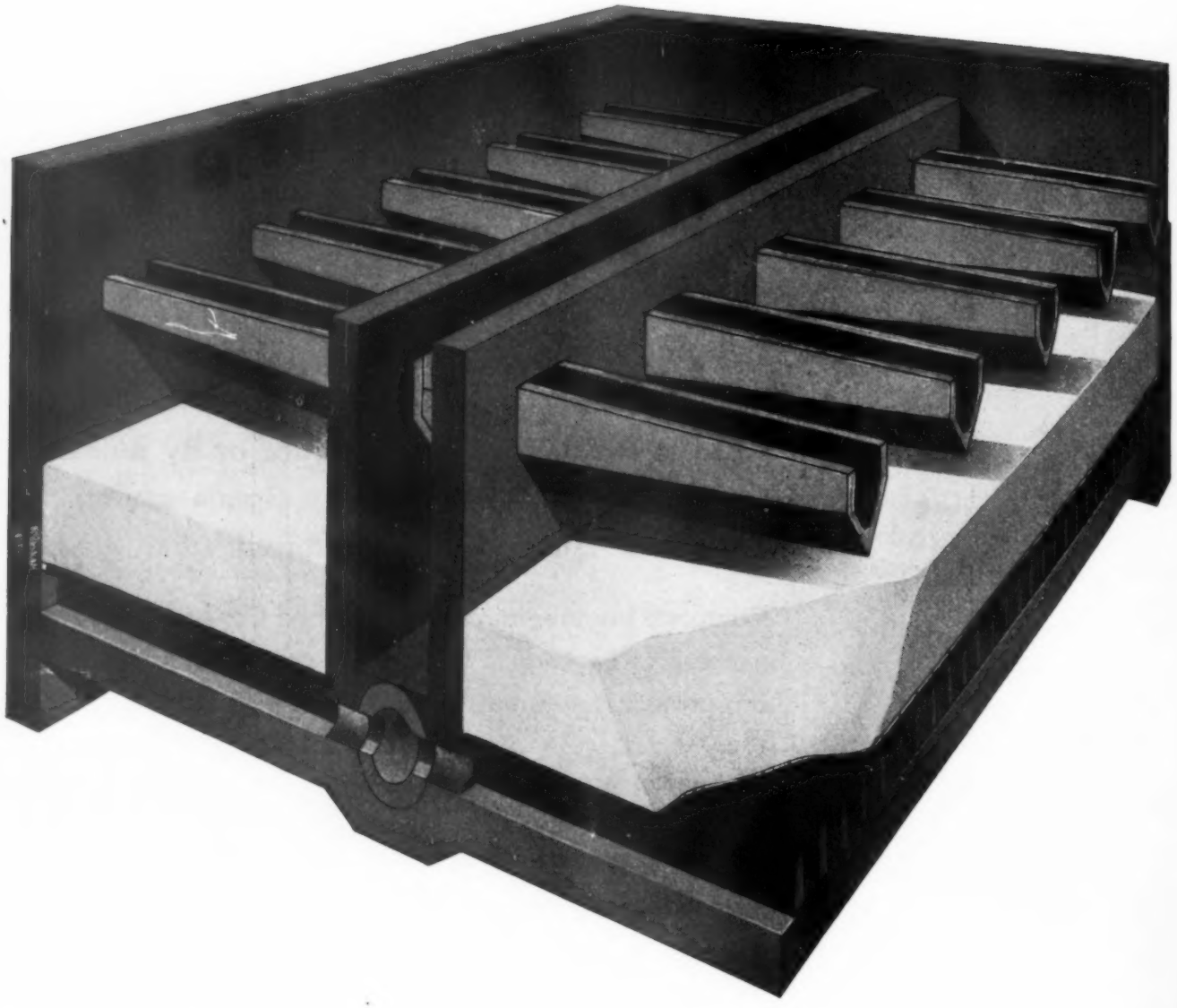
Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

ALOXITE
TRADE MARK

POROUS UNDERDRAIN SYSTEM

Eliminates

- MUD BALLS
- DEAD SPOTS
- GRADED GRAVEL DISTURBANCE



HIGH HEAD LOSS
•
EXCESSIVE WASH WATER VOLUME
•
SHORT FILTER RUNS

HIGH MAINTENANCE COSTS
•
STRAINER CLOGGING

All troubles caused by graded gravel disappear on installing the ALOXITE aluminum oxide porous plate underdrain system in rapid sand filters.

Dispensing with graded gravel, displacement is no longer a problem. Mud balls are eliminated. Backwashing is uniform over the entire bed. Less wash water is required to maintain clean filter media. Longer filter runs are frequently obtained.

Added to these benefits is lower filtering and backwashing operating heads. They result from smaller pressure loss through the underdrain system and reduced filter heights.

More complete data are provided in Engineering Bulletin No. 2. For a copy, write Department O-37, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

Underdrain Plates

BY CARBORUNDUM
TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

Everdur Metal

permits Strong, Lightweight, Built-up Construction . . .

THE OPERATING ADVANTAGES of construction that combines strength with light weight are well known to sewage and water works engineers. Such construction is possible with Everdur* because these durable copper-silicon alloys combine high strength with excellent resistance to corrosion.

Everdur Copper-Silicon Alloys are readily workable and weldable, and are available in plates, sheets, rods and tubes. Standard compositions are manufactured for hot or cold working and machining. There is practically no limit to the types of equipment into which this durable, economical metal can be fabricated. For detailed information, write for Publications E-11 and E-5. 46213 Rev.

* Reg. U. S. Pat. Off.

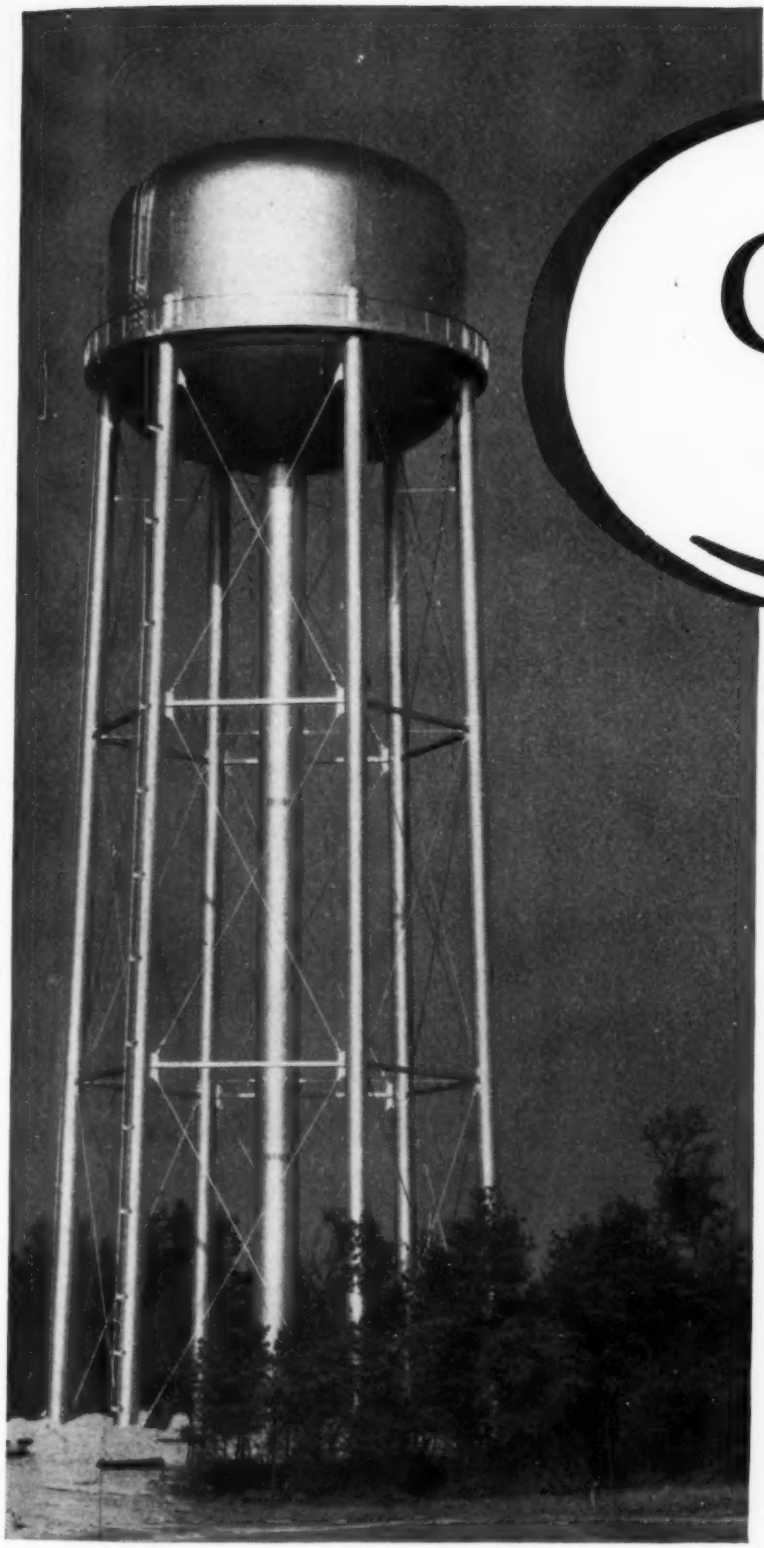
ANACONDA

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: ANACONDA AMERICAN BRASS LTD.,
New Toronto, Ont.



The above Horton ellipsoidal-bottom elevated tank was recently erected at Falmouth, Mass. It holds 250,000 gals. and is 111 ft. to bottom. Tanks of this type have a relatively large diameter and shallow depth which reduces the variation in pressure between the upper and lower levels.

Falmouth O.K.'s *its new* HORTON elevated tank!

"Very well pleased with its appearance and construction" . . . that's how Falmouth, Massachusetts, feels about its new Horton elevated water tank, shown at the left. This city is proud of its water supply system, which is unusual in that it consists of about 120 miles of mains to supply approximately 3,300 consumers. It's a popular vacation spot and hence, from October 1st to April 1st, there are only about 1,600 water users. Yet, during the peak of the summer season, daily consumption approaches 3 mgd.

The main source of supply is a fresh-water lake in the westerly section of the city. An auxiliary source from shal'ow driven wells is located near the east side of the system. A steam pumping station, on the shore of the lake, with gasoline engine-driven standby pumps, operates the year 'round, while the auxiliary wells serve during peak requirements.

The new 250,000-gal. Horton elevated tank is located about 4½ miles from the pumping station near the eastern extremity of the city. Prior to the erection of the tank a deficiency in pressure existed at hours of peak demand, and fire protection was inadequate. It is expected that the new elevated tank will maintain satisfactory pressure at all times, and substantially improve fire flow. The city also has approximately one million gallons in standpipes located along the western side of the distribution system.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th St.
Atlanta 3.....2181 Healey Bldg.
Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Dr.
Philadelphia 3.....1644-1700 Walnut St. Bldg.
Havana.....402 Abreu Bldg.
San Francisco 11.....1283-22 Battery St. Bldg.
Detroit 26.....1551 Lafayette Bldg.
In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

36" cast iron cement lined flanged discharge header at Houston, Texas, connecting with 36" main of Mono-Cast Centrifugal Pipe. Economical and corrosion-resistant, Acipco Mono-Cast pipe and fittings are cast in diameters 3" through 48", inclusive, and are supplied with or without tar coating, cement or Enameline lining.

For Superior Service and Long Life at Low Cost Specify Acipco Mono-Cast Pipe and Fittings

Mono-Cast Pipe is centrifugally cast in sand-lined molds—a process which produces a pipe of superior metal structure that is strong, dense, fine-grained, free of inclusions and blowholes, and tough though easily machined. It is unexcelled for conveying gas, oil, water, sewage and other liquids. In addition to the flanged joint, Mono-Cast Pipe is available with five other types of standard joints: Bell and Spigot, Doublex Simplex, Screw-Gland, Roll-On-Rubber Ring and Molox Ball and Socket. These joints and a full line of standard accessory fittings make it easy to install under varying service and laying conditions.

AMERICAN CAST IRON PIPE COMPANY

Birmingham 2, Alabama

IN { NEW CONSTRUCTION / PLANT EXTENSION / REPAIR WORK

curb excessive maintenance

with BYERS WROUGHT IRON

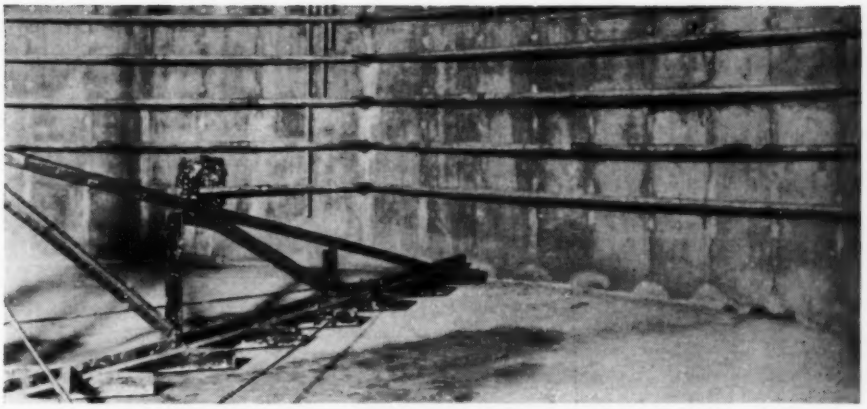
The leading question in the mind of every thoughtful man concerned with sewage treatment plant construction is the minimizing of future maintenance. The leading answer is Byers Wrought Iron.

The best indication of the superior service qualities of wrought iron is found in its almost universal use for the hottest spots in treatment plants. Digestion coils, for instance, represent one of the most punishing services of all. The naturally high corrosiveness of the sewage is increased by elevated temperatures. Where engineers have had a chance to observe and compare . . . you'll generally find wrought iron on the job.

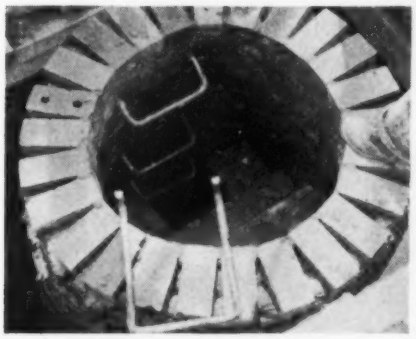
Stirring mechanisms face the same conditions. In one western plant, the original mechanism, made of low-first-cost materials, lasted only a year. Then wrought iron was used . . . and at last report had been seven years on the job, with no sign of failure.

In Manhole ladder steps, the trend is definitely toward wrought iron; many municipalities have already standardized on the material. Engineers, bothered with frequent failures of steps made of other metals, remembered that when wrought iron was used there had been no difficulties . . . and acted accordingly.

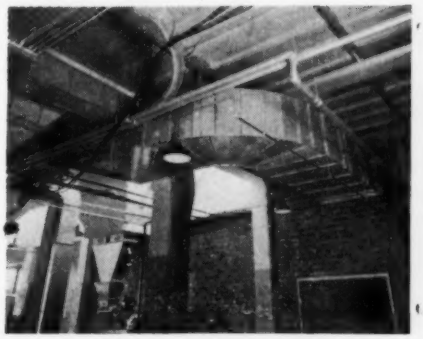
Call the roll of the most corrosive services in the treatment plant, and you'll have a good check list of the places where wrought iron is solving maintenance problems to the complete satisfaction of users. If you would like to review the use that modern plants are making of wrought iron, and to see some of the performance records that support the choice, ask for our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations."



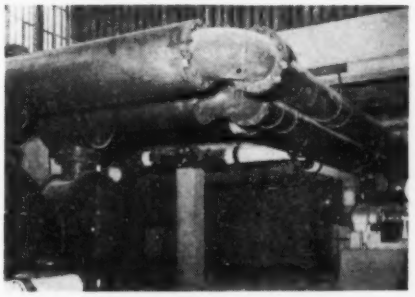
DIGESTER COILS AND STIRRING MECHANISM



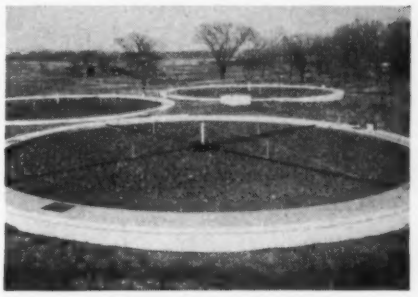
MANHOLE LADDER STEPS



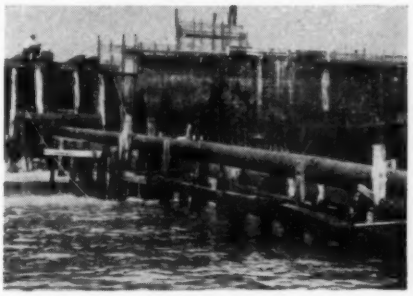
VENTILATING DUCTS



SLUDGE GAS LINES



DISTRIBUTOR ARMS



OUTFALL LINES

TRASH RACKS AND SCREENS

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

This is Milwaukee...

Turbines . . . other power generation equipment.

Transformers — all types and sizes 1½ kva and up.

Unit substations — available in any practical size.

Motors 1 hp and up; controls; V-belt drives.

ALLIS

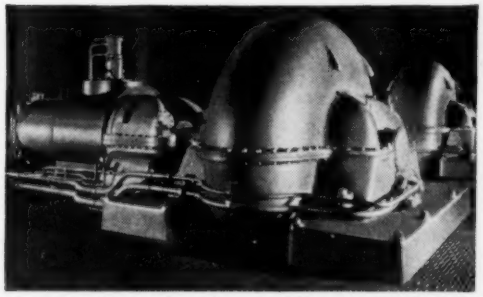
1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great

One of the Big 3 in Electric Power Equipment

Population 618,000

Allis-Chalmers Equipment Plays a Vital Role In Its Efficient System of Public Works

AMERICA KNOWS MILWAUKEE for good government, lovely homes, beautiful harbor and famous industries. Here, truly, lies an important cog in America's industrial life. For, from Milwaukee comes machinery that serves all industry . . . all America.



A-C steam turbine driven blower in Milwaukee sewage plant.

One of Milwaukee's "silent servants" is the world's pioneer activated sludge sewage plant. Machines like the turbine and blower above play a vital role in the efficient operation of the city's public works. Turbines, blowers, motors, pumps, sifters, screens . . . all these and more supplied by Allis-Chalmers, *builders of the world's widest range of public works equipment.* Big city, medium or small, our experts are ready to help with your equipment problems. Call your nearby A-C office or write to ALLIS-CHALMERS, MILWAUKEE 1, WIS.

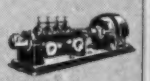
A 2158

CHALMERS

Biggest of All in Range of Industrial Products!

Switchgear; power distribution equipment.

Blowers, compressors in most sizes to fit all jobs.

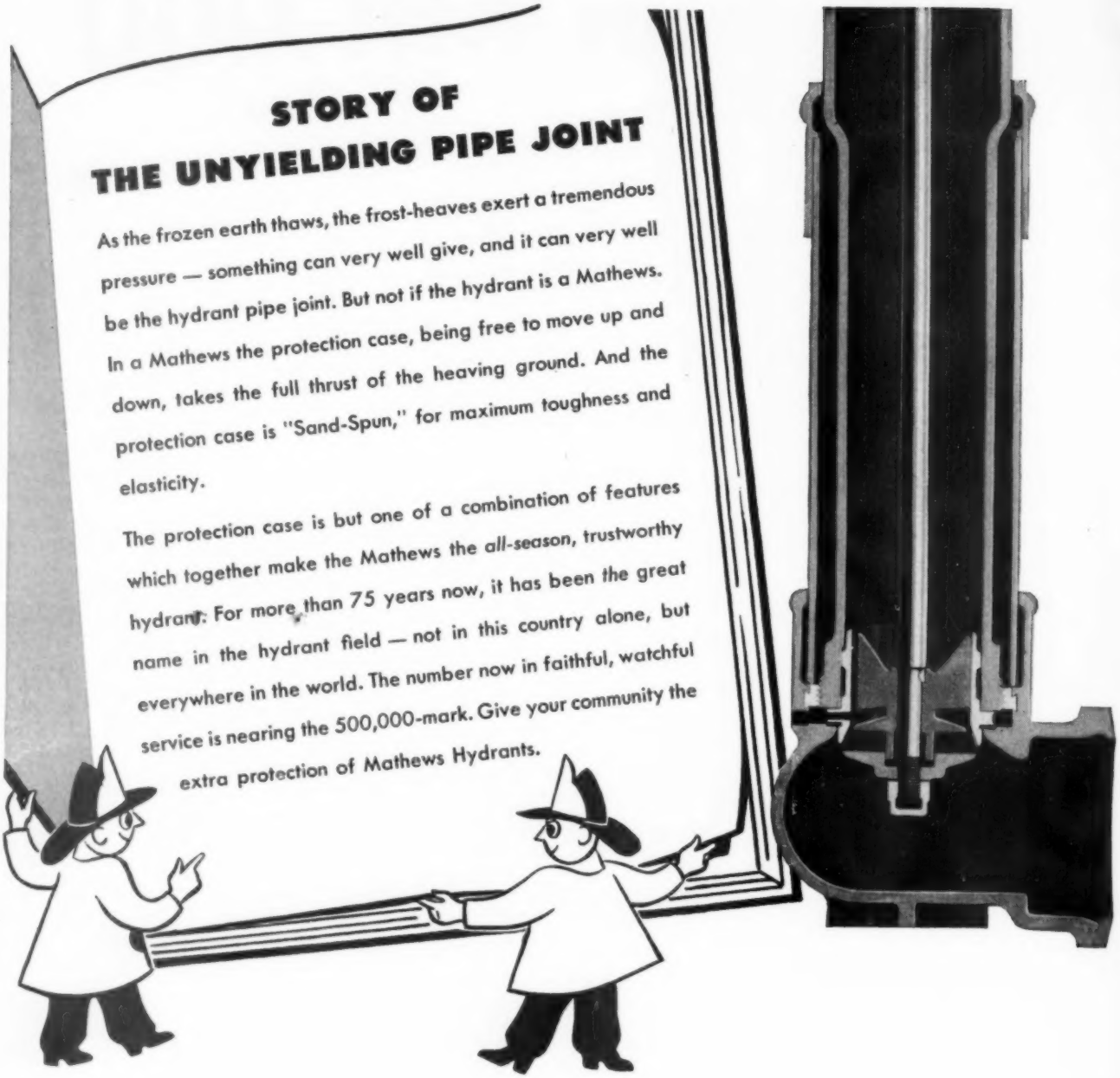


Centrifugal pumps; types, sizes to 160,000 gpm.

STORY OF THE UNYIELDING PIPE JOINT

As the frozen earth thaws, the frost-heaves exert a tremendous pressure — something can very well give, and it can very well be the hydrant pipe joint. But not if the hydrant is a Mathews. In a Mathews the protection case, being free to move up and down, takes the full thrust of the heaving ground. And the protection case is "Sand-Spun," for maximum toughness and elasticity.

The protection case is but one of a combination of features which together make the Mathews the *all-season*, trustworthy hydrant. For more than 75 years now, it has been the great name in the hydrant field — not in this country alone, but everywhere in the world. The number now in faithful, watchful service is nearing the 500,000-mark. Give your community the extra protection of Mathews Hydrants.



OTHER FEATURES OF MATHEWS LEADERSHIP

Barrel, containing all working parts, is removable. Repair or replacement is entirely above-ground. Head can be rotated a full circle, on swivel flange. Replaceable head permits change in nozzle outlets. Nozzle levels can be raised or lowered. Barrel screws into bronze bushing in elbow. Operating thread (easily accessible) is only part that needs oiling. A modern barrel makes even the oldest Mathews good as new.

MATHEWS HYDRANTS

Made by **R. D. WOOD COMPANY**

PUBLIC LEDGER BUILDING, INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.

MANUFACTURERS OF "SAND-SPUN" PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

HYDRO-TITE

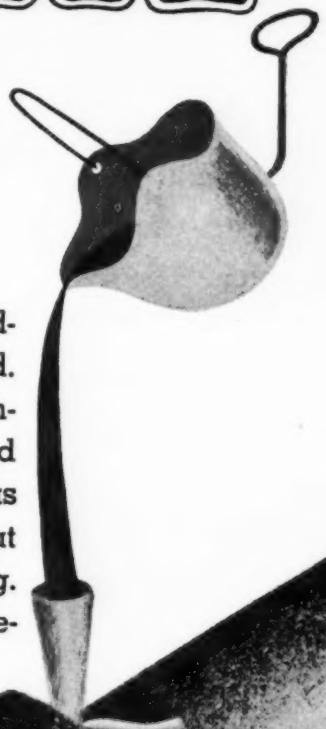
BETTER THAN LEAD

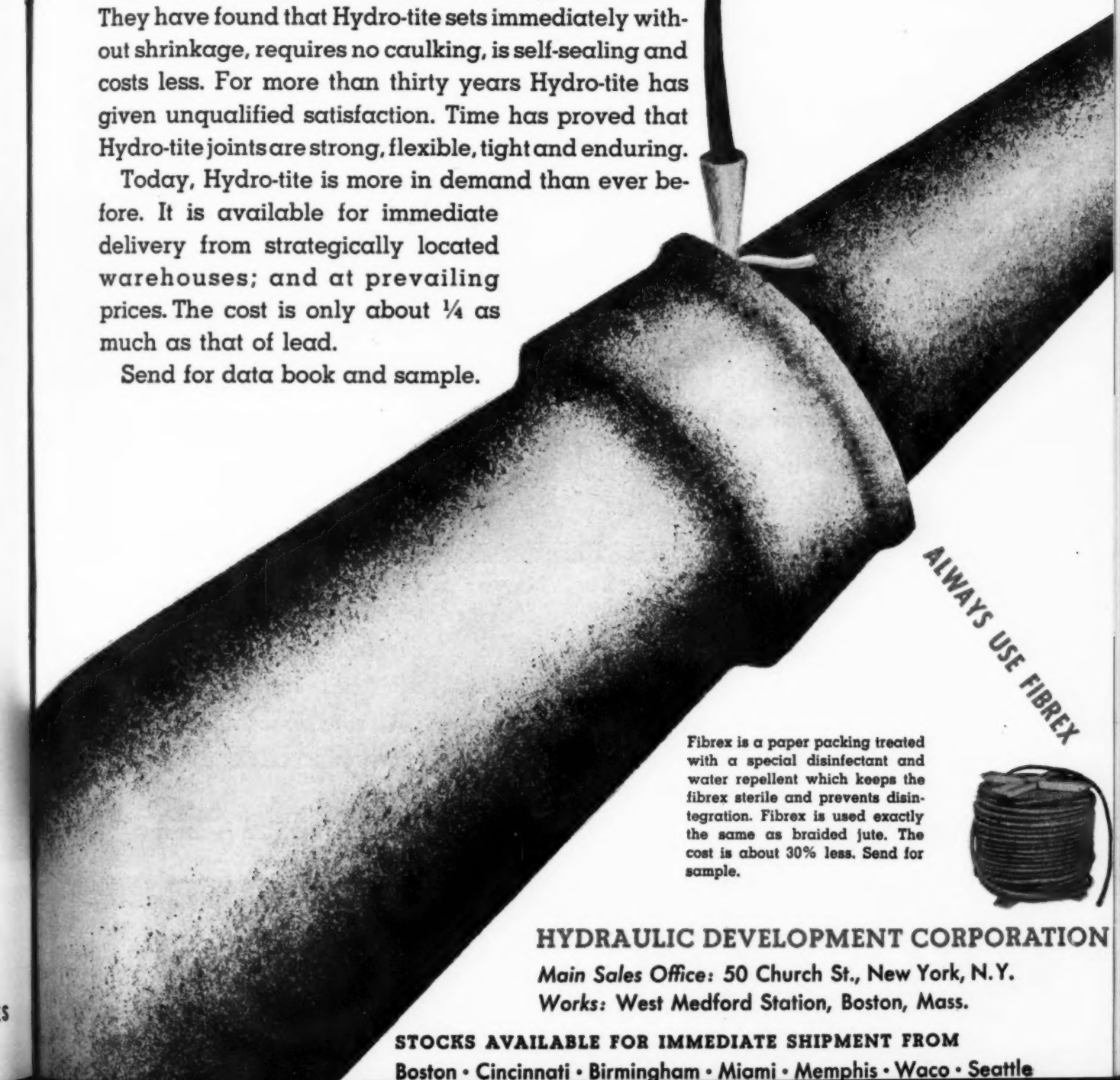
and available for immediate delivery

For more than thirty years water works superintendents have used Hydro-tite because it is better than lead. They have found that Hydro-tite sets immediately without shrinkage, requires no caulking, is self-sealing and costs less. For more than thirty years Hydro-tite has given unqualified satisfaction. Time has proved that Hydro-tite joints are strong, flexible, tight and enduring.

Today, Hydro-tite is more in demand than ever before. It is available for immediate delivery from strategically located warehouses; and at prevailing prices. The cost is only about ¼ as much as that of lead.

Send for data book and sample.





ALWAYS USE FIBREX

Fibrex is a paper packing treated with a special disinfectant and water repellent which keeps the fibrex sterile and prevents disintegration. Fibrex is used exactly the same as braided jute. The cost is about 30% less. Send for sample.

HYDRAULIC DEVELOPMENT CORPORATION

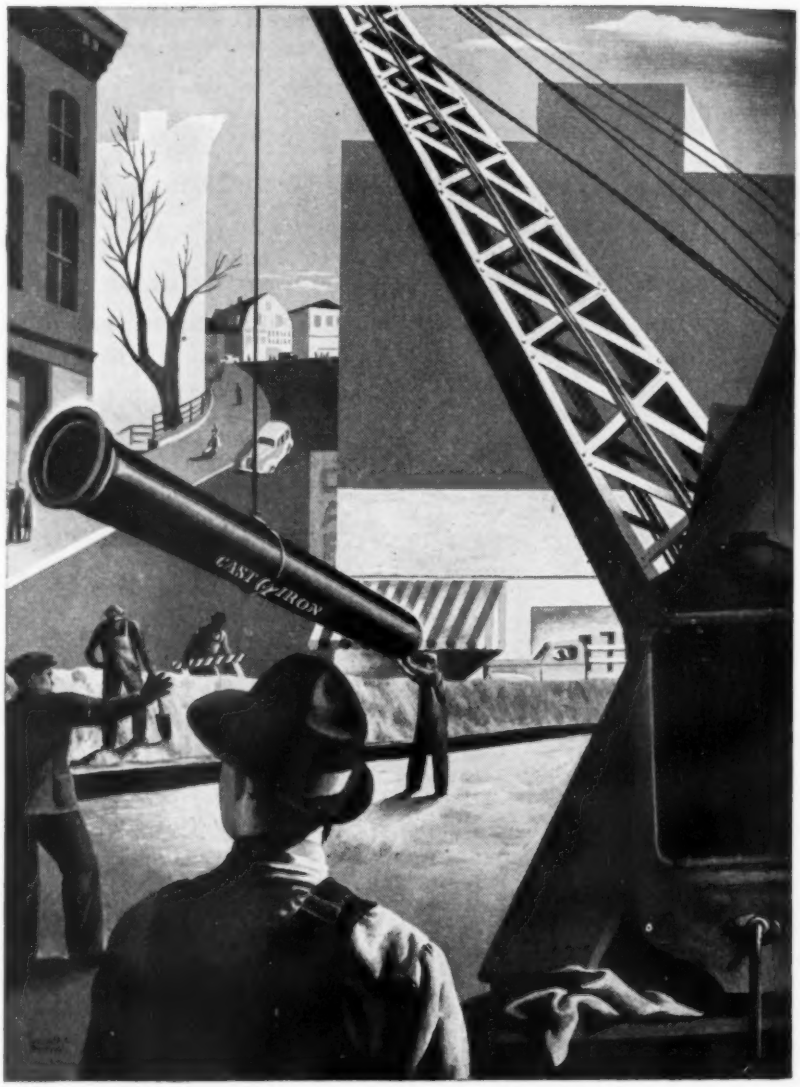
Main Sales Office: 50 Church St., New York, N.Y.

Works: West Medford Station, Boston, Mass.

STOCKS AVAILABLE FOR IMMEDIATE SHIPMENT FROM

Boston • Cincinnati • Birmingham • Miami • Memphis • Waco • Seattle

NOW THE FIRST 100



In Boston, New York, Philadelphia, and other large cities, cast iron mains are still functioning after more than a century of efficient service. They were laid in the days of horse-drawn vehicles. They were made in the days of rule-of-thumb methods.

They did not have to share the underground with electric power, steam and telephone conduits, sewers and subways. There were no skyscrapers or ten ton trucks. Yet there are more than a score of century-old cast iron mains which have survived stresses, undreamed-of when they were made and laid, that are still rendering efficient service. Certainly the first hundred years of the cast iron water main, laid in Philadelphia in 1822, were not the easiest.

By comparison, cast iron pipe as made today under scientific metallurgical and production controls, and installed by modern equipment and methods, can be confidently expected to live up to the statement in the headline of this advertisement. For cast iron pipe, as it is made and laid today, the first hundred years are now the easiest. Barring abnormal soil conditions, cast iron pipe offers centuries of efficient service.

And by efficient service is meant:

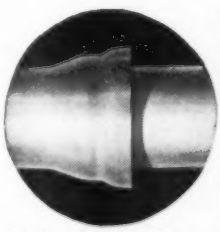
CAST IRON PIPE

YEARS ARE THE EASIEST

"Cast iron pipe not only offers a century or more of efficient life as a structure—it offers a century or more of efficient life as a carrier. In the limited areas with tuberculating waters, cement-lined cast iron pipe is tuberculation-proof and insures high carrying capacity for the life of the pipe. In the greatly predominating areas without tuberculating waters, the carrying capacity of unlined cast iron pipe remains practically unimpaired for the life of the pipe."

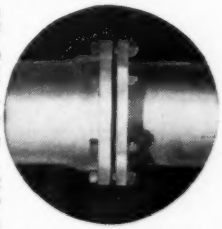
Under the auspices of the American Standards Association, sponsored by the American Water Works Association and other pipe-using organizations, required strengths and thicknesses of cast iron pipe have been computed to meet specific service conditions—the result of a decade of research. For cast iron pipe made a century ago, the first 100 years were the hardest. For cast iron pipe as produced today, there is every reason to believe that the first 100 years will be the easiest.

Joints for Cast Iron Pipe



Bell-and-Spigot Joint: the standard joint for water and sewerage service.

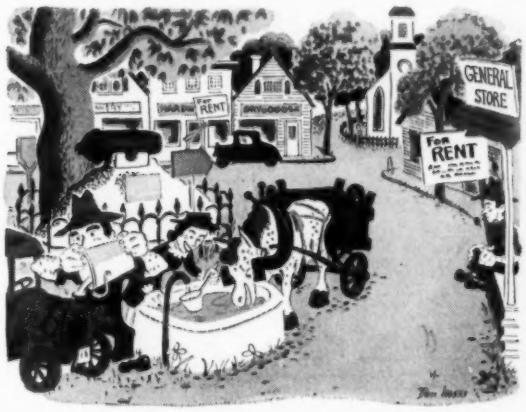
A variety of joints are available, of which the two most widely used are illustrated. Special purpose joints, such as the Ball-and-Socket, or Flexible Joint for underwater use, and the Flanged Joint for above-ground use, are also available.



Mechanical Joint: bottle-tight and flexible, now with interchangeable parts.

PUBLIC WATER SUPPLY —the Forgotten Industry

The public takes piped running water for granted—until it's turned off. A good public water supply is never news—except on the rare occasion when something goes wrong. To help create public awareness of the service rendered by America's water supply systems, the Cast Iron Pipe Research Association is presenting little known facts about public water supply to the *six million* influential readers of "Time" and "Nation's Business." For example, the following illustration and excerpts from a current advertisement:



Town without a future

The town without a future is the town without a public water supply system. Community growth depends on an adequate supply of running water for both home and industrial use.

Sewer systems, for example, cannot function without public water supply. Purification processes have so improved health conditions that typhoid has been reduced almost to the vanishing point.

Due credit for the progress of any town should be given to the farsighted planning and efficient operation of its public water supply system, all too often taken for granted. Yet it is the most important public service in any community, literally indispensable.

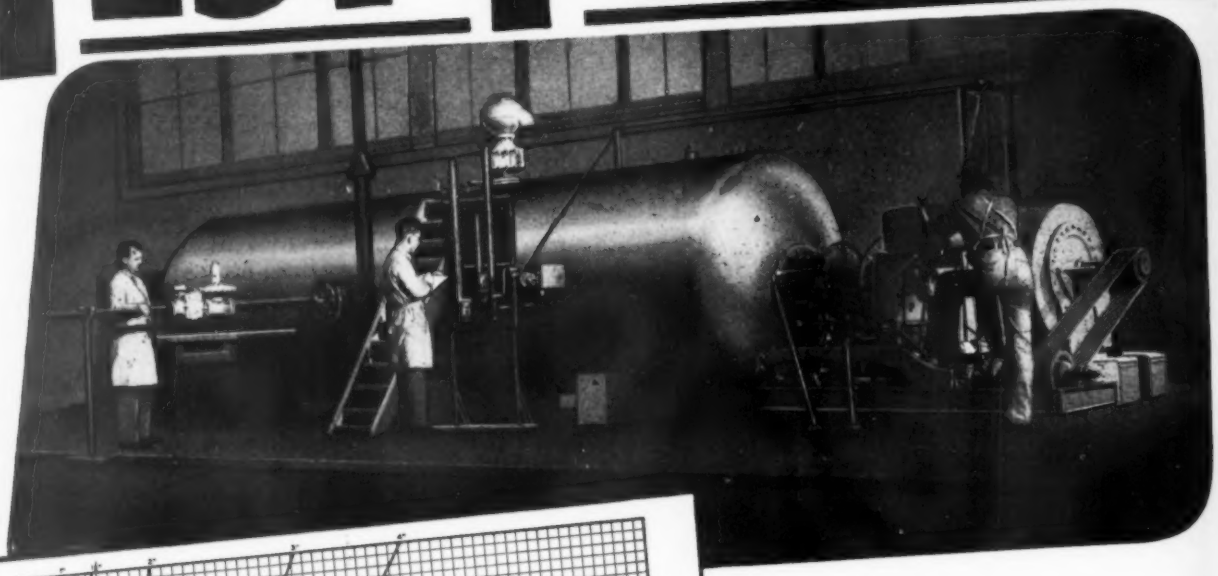
* * *

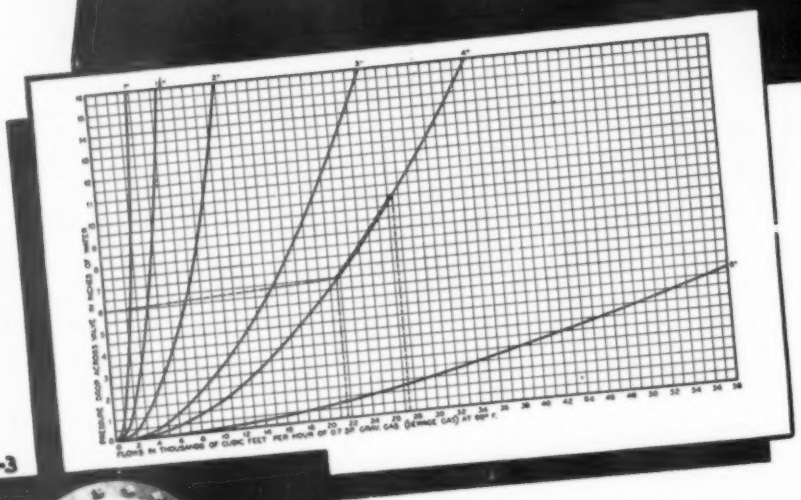
If your town is planning a water supply system, remember that some or all of the original cast iron water mains are still serving in 200 of America's largest cities.

Cast Iron Pipe Research Association, T. F. Wolfe, Research Engineer, Peoples Gas Bldg., Chicago 3.

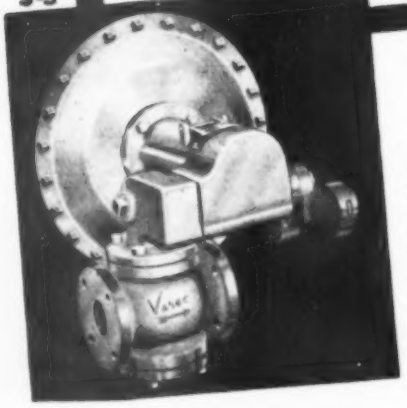
SERVES FOR CENTURIES

...IF IT'S "Varec" - IT'S TEST-PROVED





S-3



"VAREC" approved SEWAGE GAS CONTROLS

THE "VAREC" Testing Laboratory illustrated above includes what is probably the largest and most up-to-date capacity finding apparatus in existence. It accurately determines pressure loss and flow capacities up to 500,000 cubic feet per hour. Characteristics of gases when mixed with foreign elements as well as corrosive qualities are also determined by thorough analysis and test investigations. All "VAREC" Equipment is tested to exact field application; the large vessel reduces velocity head to a true static head, thus giving true capacity and pressure drop. Write for your copy of the new "VAREC" Sewage Gas Control Handbook S-3, which gives factual information determined in this laboratory, as well as diagrams, charts, and other data of great value to sanitation engineers.

"VAREC" approved BACK PRESSURE REGULATOR (DOUBLE PORT)

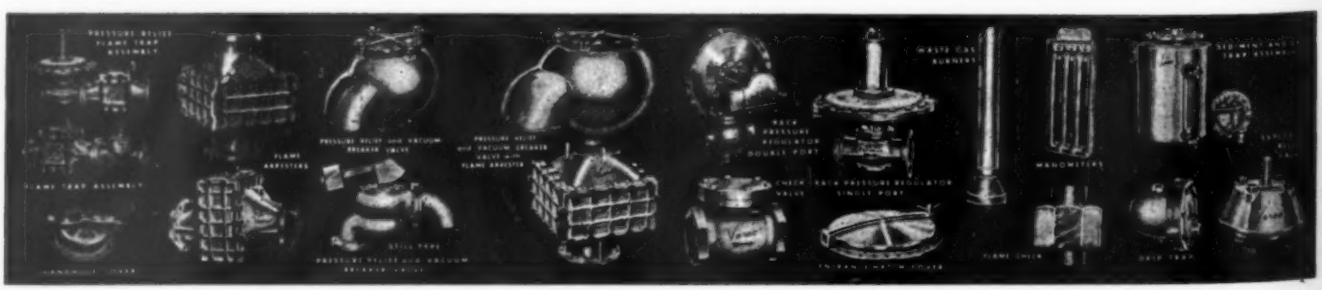
FIGURE NO. 186.

The above chart shows actual flow capacities. This regulator will maintain a back pressure to within 5% of the desired predetermined pressure. It is particularly advantageous for installation where dependable, delicate up-stream control is important.

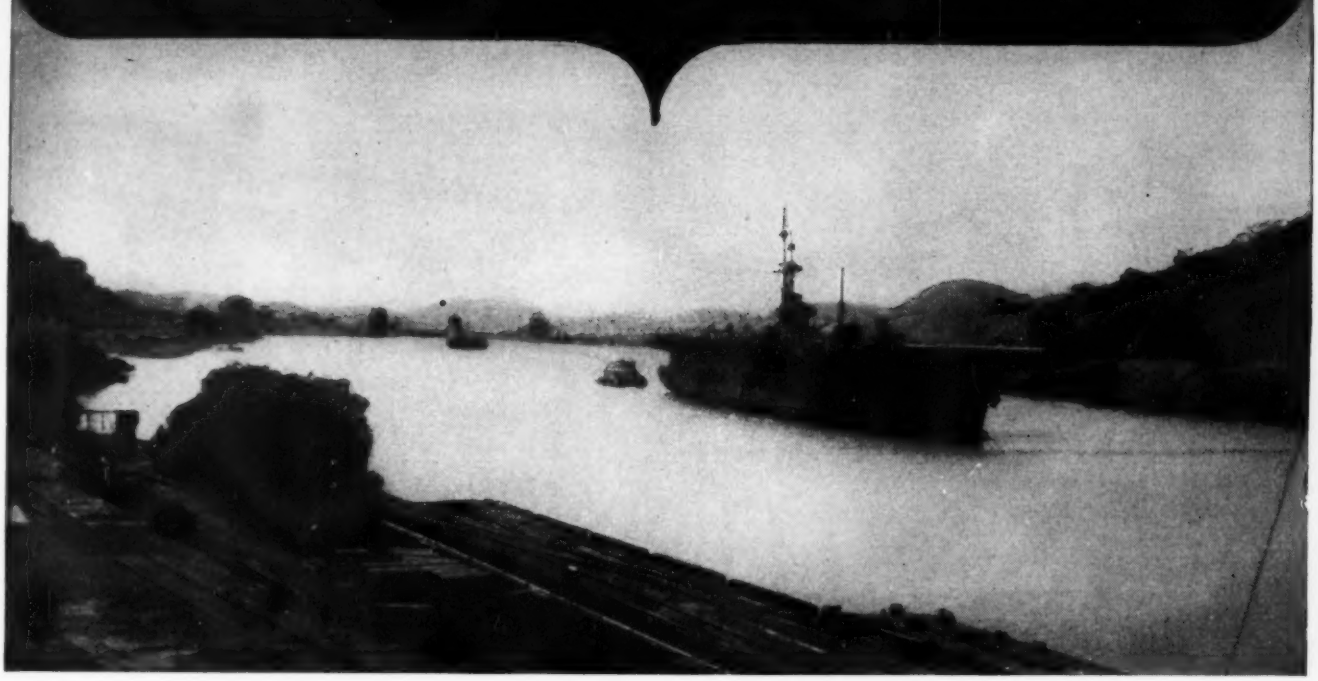
THE PACE SETTER SINCE 1928

THE VAPOR RECOVERY SYSTEMS CO.
COMPTON, CALIFORNIA
NEW YORK CITY—CHICAGO, ILL.—HOUSTON, TEX.—CLEVELAND, OHIO

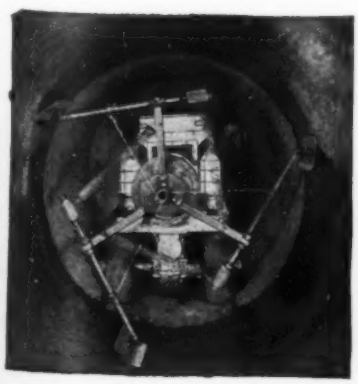
Agencies Everywhere
Cable Address: VAREC-COMPTON (All Codes)



CENTRILINES



• • • **CENTRILINE** has recently reconditioned for the Government, the 58,000 feet of 30 and 36 inch cast-iron pipe line from Gamboa Pumping Station to Miraflores, Panama Canal Zone. The increased carrying capacity will now be permanently maintained by the thin, dense, smooth cement mortar lining centrifugally applied—a reliable guarantee against future tuberculation, underlying deterioration of metal and increased pumping costs.

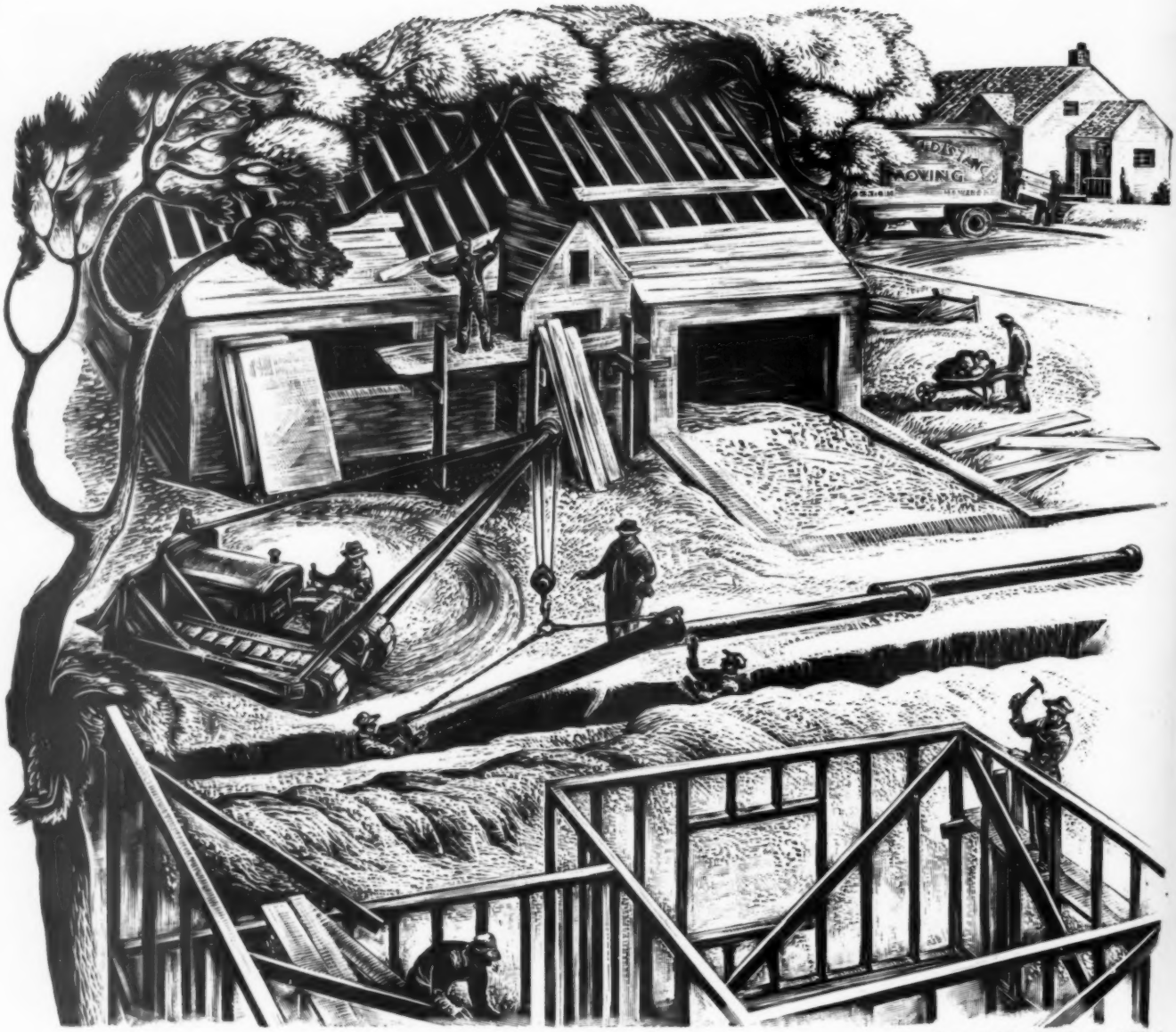


The Centriline process is a rapid, economical method of reconditioning pipe lines 30" and larger. After cleaning, a thoroughly premixed cement mortar lining of desired thickness is applied centrifugally without rebound. This dense quality product is mechanically trowelled to a smooth finish providing maximum carrying capacity which is permanently sustained. This work is performed underground, in place.

CENTRILINE CORPORATION

148 CEDAR STREET • NEW YORK 6, N. Y.

Restores and Protects Pipe-Line Carrying Capacity

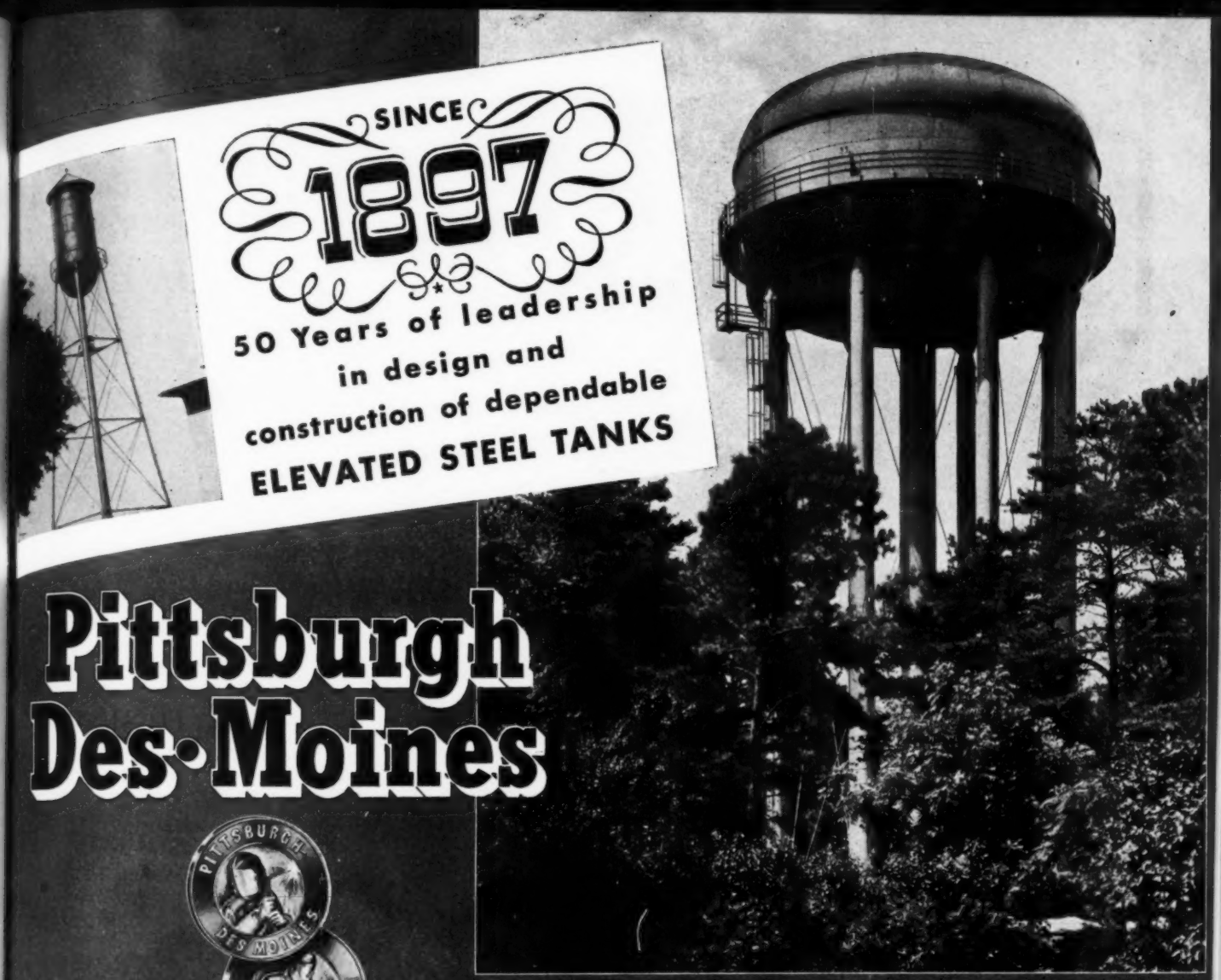


Original Woodcut by Lynd Ward

What a heartwarming thing it is for everybody—owner, neighbors, the whole nation—when the lights go on in a new house. Construction is improving, but there are still shortages of building materials and of the raw materials used in the manufacture of cast iron pipe for water, gas and sewerage services. Our five large plants are producing economical, long-lived U. S. Cast Iron Pipe and fittings to the maximum permitted by available raw materials. The outlook for increased production is favorable.

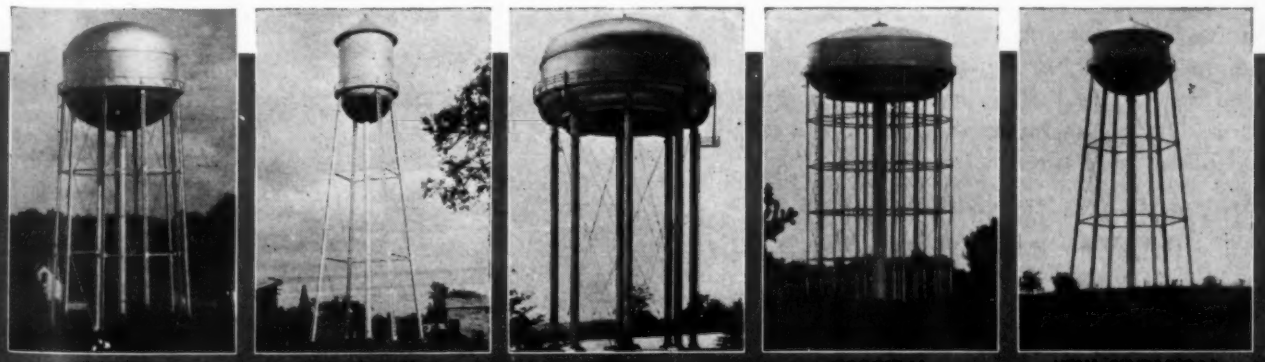
U.S. cast iron PIPE

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
Plants and Sales Offices throughout the U. S. A.



Pittsburgh Des·Moines

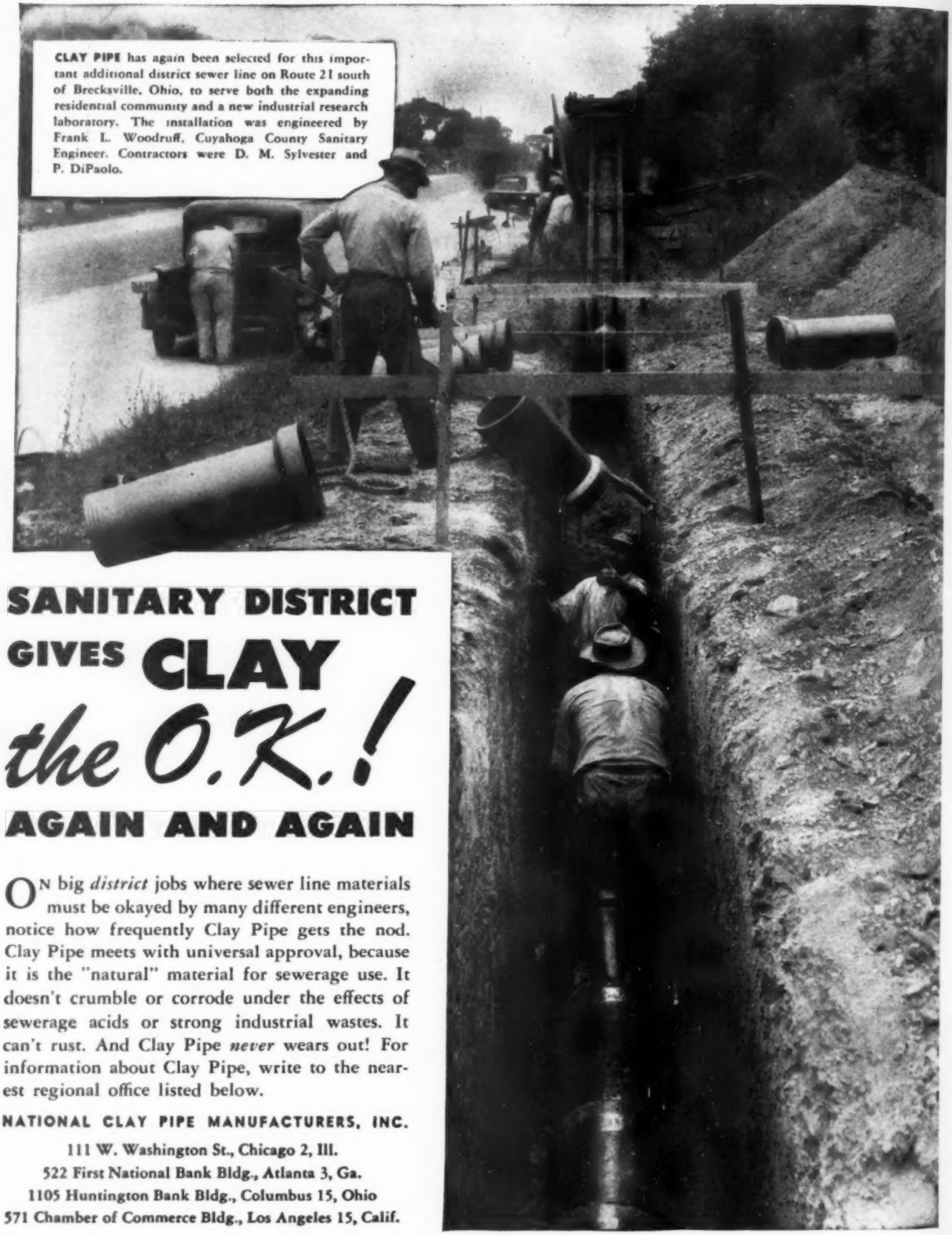
The first elevated steel tank erected by Pittsburgh-Des Moines Steel Company a half-century ago is still on the job today . . . a witness to original P.DM design and craftsmanship. The steady development of specialized elevated steel tank engineering, fabrication and erection by this organization through the years is attested by the thousands of dependable P.DM Tanks serving municipalities and industries throughout America and in several foreign countries. *May we consult on your particular requirements?*



DOUBLE-ELLIPSOIDAL TYPE

PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, PA., 3418 NEVILLE ISLAND—DES MOINES, IOWA, 919 TUTTLE STREET
NEW YORK, ROOM 918, 270 BROADWAY · CHICAGO, 1222 FIRST NATIONAL BANK BUILDING
DALLAS, 1223 PRAETORIAN BUILDING · SAN FRANCISCO, 625 RIALTO BUILDING
SEATTLE, 526 FIRST AVENUE, SOUTH



CLAY PIPE has again been selected for this important additional district sewer line on Route 21 south of Brecksville, Ohio, to serve both the expanding residential community and a new industrial research laboratory. The installation was engineered by Frank L. Woodruff, Cuyahoga County Sanitary Engineer. Contractors were D. M. Sylvester and P. DiPaolo.

SANITARY DISTRICT GIVES CLAY *the O.K.!* AGAIN AND AGAIN

ON big *district* jobs where sewer line materials must be okayed by many different engineers, notice how frequently Clay Pipe gets the nod. Clay Pipe meets with universal approval, because it is the "natural" material for sewerage use. It doesn't crumble or corrode under the effects of sewerage acids or strong industrial wastes. It can't rust. And Clay Pipe *never* wears out! For information about Clay Pipe, write to the nearest regional office listed below.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

111 W. Washington St., Chicago 2, Ill.
522 First National Bank Bldg., Atlanta 3, Ga.
1105 Huntington Bank Bldg., Columbus 15, Ohio
571 Chamber of Commerce Bldg., Los Angeles 15, Calif.

CLAY PIPE

CLAY PIPE NEVER WEARS OUT!

C-647-2

Refreshing and Palatable Water . . .

with Safety . . .

DIAMOND

Liquid Chlorine

The high quality of Diamond Liquid Chlorine is carefully controlled by skilled operators, who continuously watch the sensitive indicating and recording instruments, that reveal important facts as to conditions of the product through every phase of manufacture. That's why you can always depend on Diamond Liquid Chlorine to aid you in supplying pure, safe and palatable drinking water, and for all other water and sewage treatment needs.

DIAMOND ALKALI COMPANY

CHLORINE

Pittsburgh 22, Pa., *and Everywhere*

Lowering 72-in. reinforced concrete pipe into headframe prior to jacking under four sets of railroad tracks. Engineers, Burns & McDonnell Engineering Co. of Kansas City, Mo. Field engineering and supervision, Metropolitan Utilities District of Omaha.

Photo by Walter Craig, Omaha

72-inch Concrete Pipe Jacked Under 4 Sets of Railway Tracks

CONCRETE pipe has not only ample strength to resist impact and sustain heavy overburdens, but the structural stamina to permit jacking into place in difficult locations. This was demonstrated in a recent project at Omaha, Neb. when 908 ft. of 72-in. reinforced concrete pipe was installed under four sets of C.B.&Q. railroad tracks. More than 60 per cent of the pipe was placed by jacking.

In addition to structural strength, concrete pipe has the advantages of maximum hydraulic capacity, minimum infiltration and leakage, high resistance to abrasion, ease of installation, and moderate first cost.

These advantages mean that concrete pipe installations give many years of service at low maintenance expense, resulting in *low annual cost*—the true measure of economy in pipe lines.

PORTLAND CEMENT ASSOCIATION

Dept. A3-29, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

PENN SALT

Liquid Chlorine

CHLORINE has come to be a "standard" chemical for water purification. In addition, under certain circumstances it tends to stabilize sludge, control taste and odors, aid precipitation, prolong disinfecting action.

Chlorine is also the most generally used agent for controlling odors of sewage. It also aids in the prevention of sewer and manhole disintegration.

Pennsalt was a pioneer in liquid chlorine production in this country, and for nearly half a century has supplied high quality chlorine to industry.

PENNSALT PRODUCTS

for Water Sanitation Treatment and Sewage Treatment: Liquid Chlorine • Perchloron* • Anhydrous Ammonia • Filter Alum • Ferric Chloride • Sodium Aluminate • Quaker Improved Chlorinated Lime • Caustic Soda.

*Reg. U. S. Pat. Off.

PENNSYLVANIA SALT MANUFACTURING COMPANY

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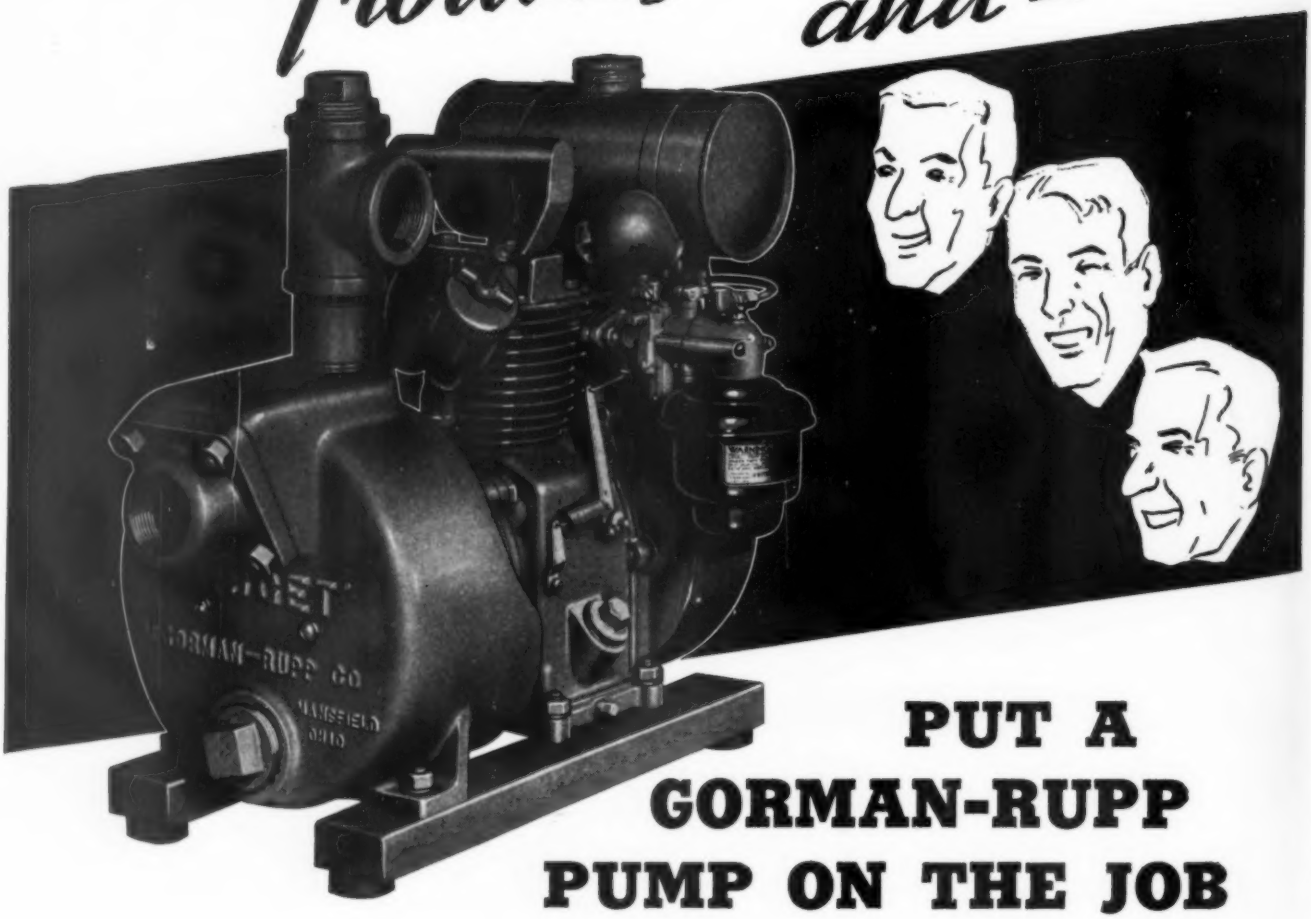
NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • CINCINNATI • WYANDOTTE • TACOMA • PORTLAND, ORE.

"Pack up your Troubles" and—



PUT A GORMAN-RUPP PUMP ON THE JOB

You can't go wrong with a trouble-free Gorman-Rupp self-priming, centrifugal pump. They ask no time off for rest or repairs. They will handle any muck or solids that will pass the intake strainer without damage to the pump. They are automatic self-priming; have no valves to tinker with; no by-passes to rob efficiency.

The Midget is the smallest of more than 50 models of Gorman-Rupp pumps. It weighs only 60 pounds and will handle 3000 gallons per hour against a 20 foot head and will do it for months at a time without attention. Gorman-Rupp pumps are made in any size or capacity up to 125,000 gallons per hour.

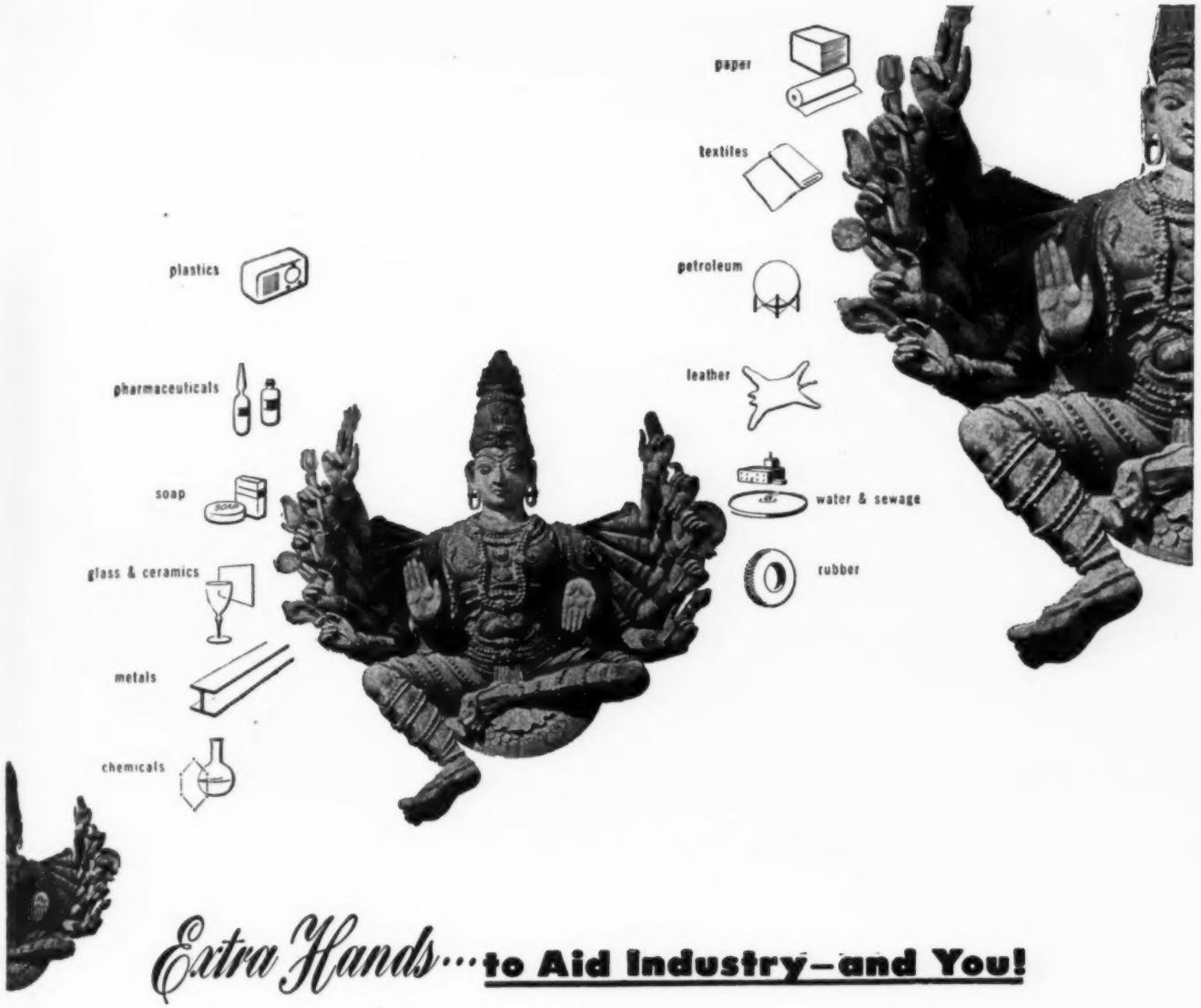
Put a Gorman-Rupp pump on your next job -- give it a tough workout and if it does not out-perform any pump you have used return it at our expense and it will not cost you a cent.

Write for further information or contact your nearest distributor.

Originators in 1936 of the Famous Blue Pump that others now imitate

THE GORMAN-RUPP COMPANY

327 Bowman Street — Mansfield, Ohio



Extra Hands···to Aid Industry—and You!

HANDLING COMPLEX PROBLEMS in the chemical process industries makes many a purchasing and production executive wish he had as many extra hands as this ancient Hindu idol to help him through—*and he has!*

THEY ARE HIS... and yours—in the cooperation and assistance of chemists, engineers, and technicians on General Chemical Company's Technical and Engineering Service staffs. These experts are well qualified by technical training and by practical industry-wide experience to offer sound, constructive advice in many ways—whether your problems deal with industrial, scientific or agricultural chemicals.

THEY CAN FURNISH pertinent data on properties, grades, and packaging of General Chemical products . . . advise on materials and methods for handling and storing them . . . consult on their applications to your operations,.. and work with you in the development of special chemicals to meet your individual requirements.

When "extra hands" such as these can help you, just phone or write to the nearest General Chemical Company Sales and Technical Service Office listed below.

GENERAL CHEMICAL COMPANY

40 RECTOR STREET, NEW YORK 6, N. Y.

BASIC CHEMICALS
GENERAL CHEMICAL COMPANY
FOR AMERICAN INDUSTRY

Sales and Technical Service Offices: Albany • Atlanta • Baltimore • Birmingham Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cleveland • Denver Detroit • Houston • Kansas City • Los Angeles • Minneapolis • New York Philadelphia • Pittsburgh • Providence • San Francisco • Seattle • St. Louis Wenatchee (Wash.) • Yakima (Wash.)

In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited
Montreal • Toronto • Vancouver

Transite asbestos-cement sewer pipe cuts infiltration to a minimum... reduces sewage treatment costs. Here's how:

(1) Sleeve-type joints make up tight . . . *stay* tight in service.

(2) Long 13-foot lengths result in fewer joints in the finished line.

Thus, *tighter* joints and *fewer* joints provide a double safeguard against infiltration. In turn, the load on the treatment plant is reduced... treatment costs are kept low. And, equally important, plant capacity is conserved for tomorrow's needs.

Other money-saving Transite advantages:

More Economical Installation—because Transite's light weight and long lengths make it easier to lay this pipe to line and grade.

Flatter Grades—Transite's high flow capacity (n=.010) often permits shallower trenches and correspondingly lower excavation costs... especially important in the case of rock excavation or wet trenches.

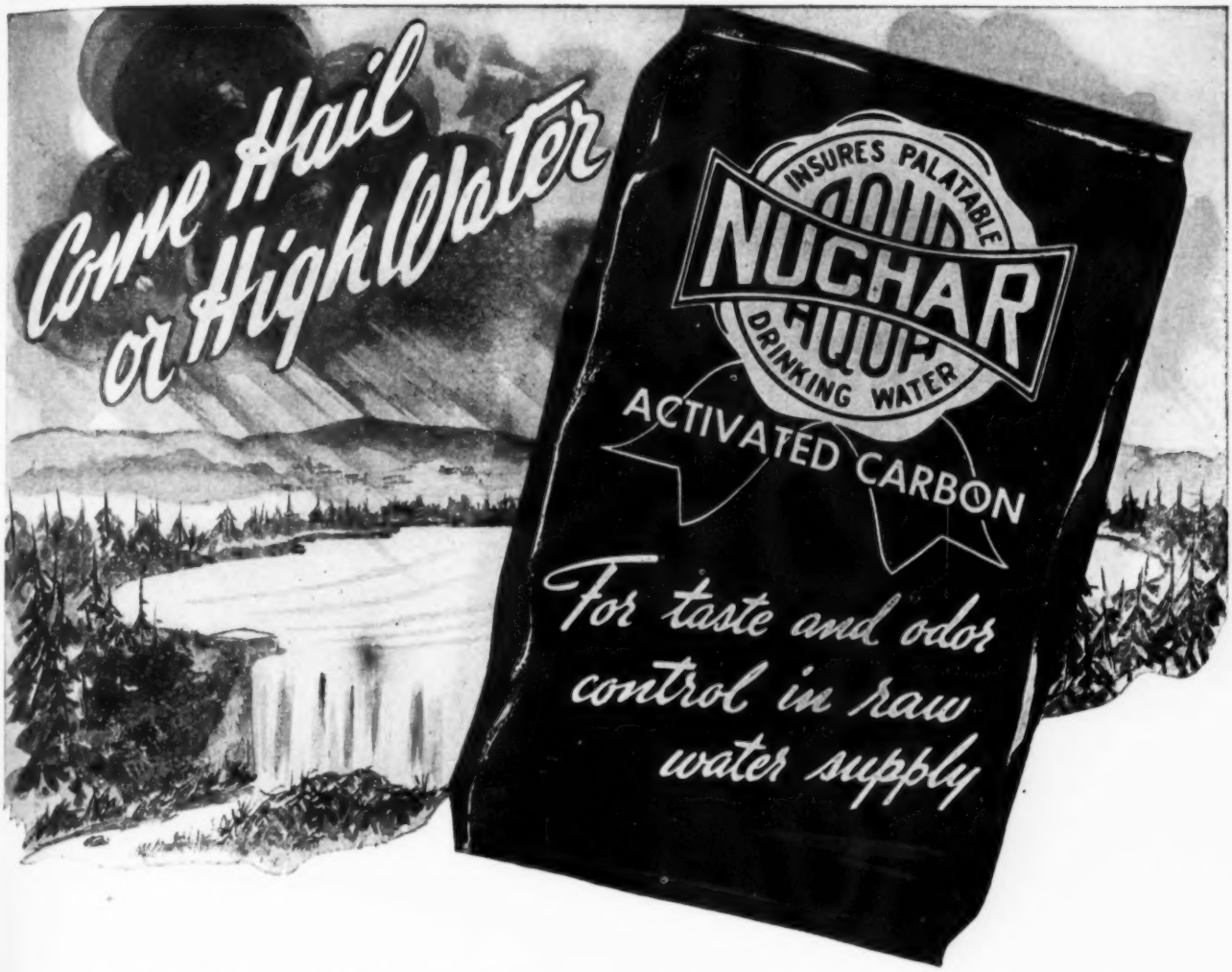
Smaller Diameter Pipe—an alternate economy to flatter grades which the designer may take advantage of when deep trenches present no serious installation problems.

High Corrosion Resistance—because of Transite's non-metallic structure that combats corrosion inside, outside and all the way through.

For all the facts, write for the Transite Sewer Pipe brochure. Address Johns-Manville, Box 290, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE SEWER PIPE



During floods and high water, odorous compounds may be flushed down to your water intake. Be prepared for any eventuality by stocking an adequate supply of Aqua Nuchar Activated Carbon to be used in the quantities indicated by frequently conducted Threshold Odor Tests.

The Threshold Odor Test supplies the means of measuring odor intensities in water. With this test it is possible to determine the quantity and quality of activated carbon which will be most effective for removing objectionable tastes and odors from an individual water supply. Municipal officials are invited to write us for full information regarding this test. Water purification experts from our Technical Service Department are available to study your taste and odor problems at no cost nor obligation.

A typical analysis of Aqua Nuchar Activated Carbon, which has been used in over 1,200 plants the country over, shows

FINENESS:

Through	100	mesh	screen	100%
"	200	"	"	99%
"	325	"	"	97%

WEIGHT PER CUBIC FOOT:

Loose	15 pounds
Packed	19 pounds

Write to our nearest office for a generous testing sample of Aqua Nuchar Activated Carbon.

NUCHAR
INDUSTRIAL CHEMICAL SALES
DIVISION WEST VIRGINIA PULP AND PAPER COMPANY
230 PARK AVENUE, NEW YORK 17, N.Y.
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748 PUBLIC LEDGER BLDG., PHILADELPHIA 6, PA.
844 LEADER BLDG., CLEVELAND 14, OHIO

72 lbs. "SMALLER"

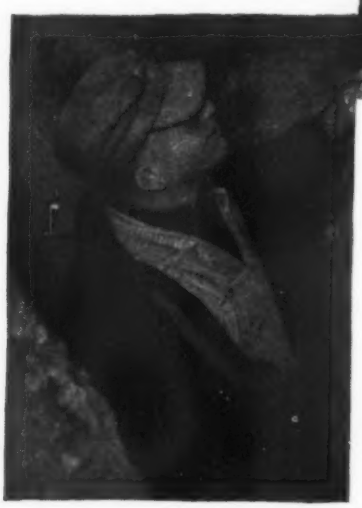
GRINNELL SOCKET FITTINGS

are easier to handle . . . cut installation time

● The 72 lb. weight advantage of this 8" Tee is typical of the space and time saving advantages of Grinnell's compact design in its complete line of socket fittings. See the table below for a tabulation of comparable sizes and weights of other popular sizes of Tees.

Socket and spigot dimensions and wall thickness are the same as AWWA Standard Class D pipe. Friction loss is not increased. Underwriters' Laboratories approved.

Write for catalog: "Water Works Specialties". Grinnell Company, Inc., Providence 1, R. I. Branch Warehouses in Principal Cities.



TEE

	Grinnell		Competition	
	Weight	Run from bell to bell	Weight	Run from bell to bell
4"	96 lbs.	11 in.	128 lbs.	22 in.
6"	147 lbs.	13½ in.	200 lbs.	24 in.
8"	222 lbs.	16 in.	294 lbs.	26 in.
10"	325 lbs.	19 in.	395 lbs.	28 in.
12"	417 lbs.	21½ in.	512 lbs.	30 in.

GRINNELL

FOUNDED 1850

WHENEVER PIPING IS INVOLVED

I know, Orgie—

I never should have been near

*PITTCHLOR

He's lucky at that! The merest contact with the Pittchlor treatment means sure destruction to chlorine-susceptible microorganisms, bacteria and algae. Highly effective in the treatment of water supplies and sewage . . . for general sanitation and odor control. Pittchlor is a 70% available chlorine calcium hypochlorite. Dry, free-flowing granules—easy to use.

** Trade Mark Reg. U. S. Pat. Off.*

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 3¼ lb. cans (12 per case) and 100 lb. drums. Write for descriptive literature covering the uses in which you are interested.

COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS

Soda Ash · Caustic Soda · Liquid Chlorine · Sodium Bicarbonate · *Pittchlor (Calcium Hypochlorite)* · Silene EF *(Hydrated Calcium Silicate)* · Calcium Chloride · Soda Briquettes *(Iron Desulphurizer)* · Modified Sodas · Caustic Ash · Phosflake *(Bottle Washer)* · Calcene T *(Precipitated Calcium Carbonate)*

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY

COLUMBIA CHEMICAL DIVISION

FIFTH AVE. at BELLEFIELD — PITTSBURGH 13, PENNA.

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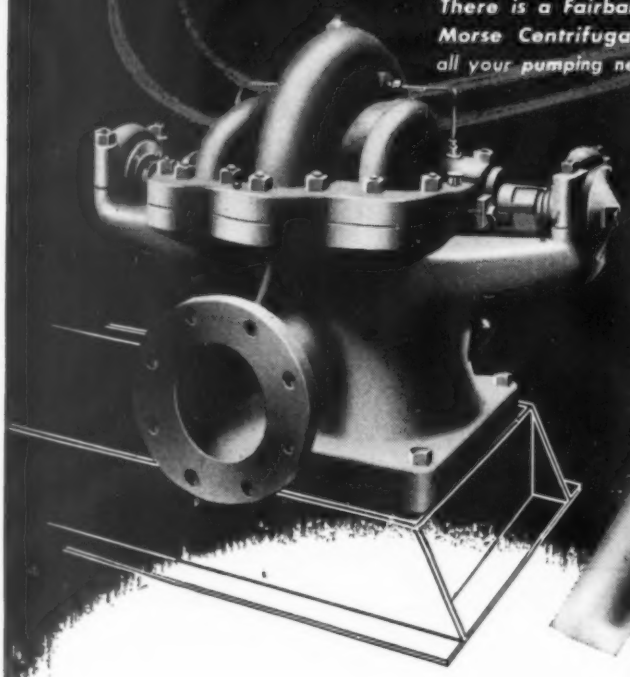
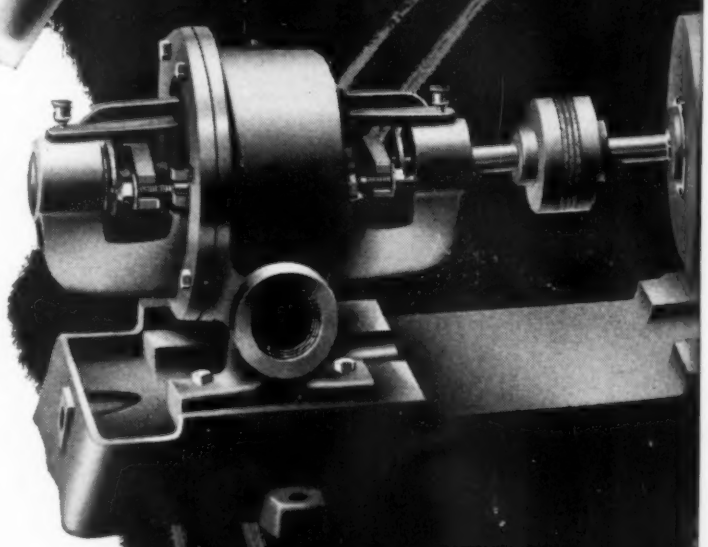
ST. LOUIS · MINNEAPOLIS · CHARLOTTE · PHILADELPHIA · SAN FRANCISCO

HERE TODAY—STILL HERE TOMORROW!

There is a Fairbanks-Morse Centrifugal for all your pumping needs.



Fairbanks-Morse-Pomona deepwell turbine pumps. Oil or water lubricated; open or closed impellers—as your job requires.



Famous Westco turbine-type pumps have exclusive advantages for service involving small capacities, high heads and low speeds.

The values in doing business with one of the hundreds of well-established, progressive Fairbanks-Morse pump dealers are many:

***First,* of course, you gain immediate advantages from the intensive research, skilled productive techniques and well-developed service organization that have long been identified with the Fairbanks-Morse name.**

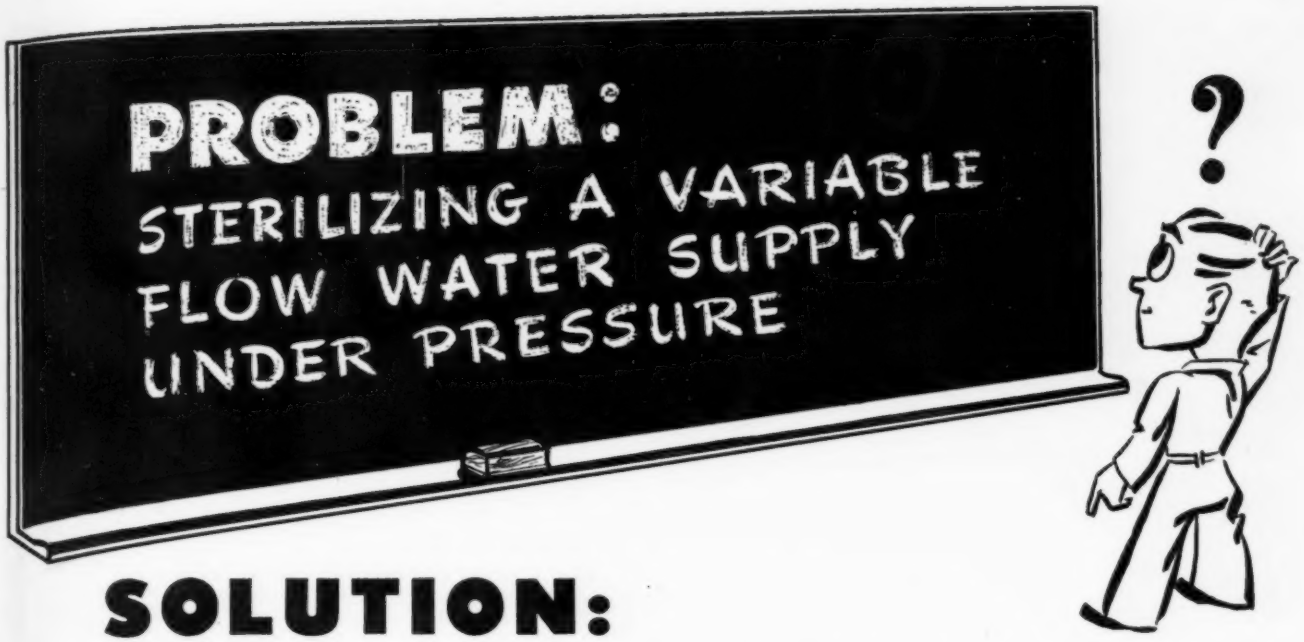
Too, you gain the long-term advantages of continued aid in keeping your pumps on the job—continued benefits from the wide-spread, quickly available Fairbanks-Morse dealer organization.

For a pump that's to give high efficiency year after year, buy from the dealer who will stand by you, year after year. See your Fairbanks-Morse pump dealer for all your pumping requirements.

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES · DIESEL ENGINES · PUMPS · SCALES · MOTORS · GENERATORS · STOKERS · RAILROAD MOTOR CARS and STANDPIPES · FARM EQUIPMENT · MAGNETOS



SOLUTION:

%PROPORTIONEERS% AUTOMATIC AND PROPORTIONAL CHEM-O-FEEDER!

Just install %Proportioneers% Automatic and Proportional Hydraulically operated Chem-O-Feeder and a standard water meter. It is only necessary to know the minimum, average, and maximum flow to be sterilized and the pressures against which the chemical will be injected. All flow is measured by the mechanical water meter and %Proportioneers% equipment starts, varies and stops dosage of chemical in step as the water comes on, fluctuates and tapers off. The %Proportioneers% Low Pressure Chem-O-Feeder shown is treating gravity water supplies against pressures up to 100 p.s.i. Installation is simple and our nearest sales and service representative will assist you in the selection of proper meter and equipment.

RESULT: Fully automatic sterilization of water supply, with chemical fed in strict proportion to flow, without dependence on electricity or other source of power. The only attention required is the occasional refilling of solution tank and checking the chlorine residual to adjust dosage for any variation in the chlorine demand of raw water.

CONCLUSION: Whatever your water treating problem, %Proportioneers% can help you; ask us for recommendations and quotations. Our experience from over 23,000 installations is at your service.

Write for Bulletin SAN-1.

% PROPORTIONEERS, INC. %

9N CODDING ST., PROVIDENCE 1, R. I.

R-S valvEvents

ISSUED PERIODICALLY BY R-S PRODUCTS CORPORATION, PHILADELPHIA 44, PA., FOR THOSE CONCERNED WITH FLOW CONTROL AND SHUT-OFF

Brutal Test of New R-S Rubber-seated Valve

A manufacturer put an R-S rubber-seated valve in service handling powdered glue. The valve was opened 9,000 times in a period of 8 hours by means of a revolving cam; then slammed shut by a 50-pound weight on the end of the valve lever. Following this abusive service, exceeding the normal life of the average valve, a test was made with air on one side and water on the other side of the vane. It was found to be bubble tight at 115 p.s.i.

Successful "Endurance" Metal

"A" metal, especially developed by R-S Products Corporation, is a tough, dense metal of uniform grain and high endurance limit. These properties give it unusual value in applications which give rise to hard wear and severe stresses. "A" metal resists galling, "wire drawing," and abrasive materials. It is also a general material of engineered construction to replace steel. Its characteristic properties are obtained by special analysis and close cupola control. Any R-S Butterfly Valve can be supplied in "A" metal.

R-S "H"-Metal 60" Butterfly Valve

Chain-wheel manually operated control for service handling gases at 15 p.s.i., 800°F. Body and vane castings are of R-S "H" heat-resisting metal. Shafts are of Stainless Steel, stellited, with alloy bushings. Finned stuffing-box.

Heat-resistant Metal

"H" metal is an alloy semi-steel that machines like cast iron. Tensile strength is 50,000 p.s.i. maximum, and 25,000 p.s.i. at 1000°F. "H" metal is heat-treated and withstands high pressure and penetration of steam and gases up to 1000°F. An important advantage is its cost, which is below that of steel. Any R-S Butterfly Valve can be furnished in "H" metal.

Butterfly Valves in Paper Mills

The need for perfect and speedy flow control in paper mills is increasing the use of R-S Butterfly Valves in this field.

A recent order from the St. Regis Paper Company covers 14 valves, in various sizes for various uses. Four 12" valves of Type 526 are used for Screen Inlets. These are heavy duty valves with 125# flanges, 18-8 Stainless Steel shafts, and bronze bushings. These are controlled by handwheel with 4-foot extension. A similar valve with shorter extension is used for Washer Dilution.

One 12" valve of Type 432 is used for Knotter Dilution, one of the same type in the 18" size for Screen Dilution, and one of 6" size for Re-pulper Dilution. For Stock Chest Pumps there are six valves which, except for bronze bushings, are Type 316 Stainless Steel throughout. Two are of 12" size and four of 8" size.

International Paper Company is also using R-S Butterfly Valves widely in its Southern Kraft mill in Louisiana. These are mostly of Stainless Steel, R-S Type 522, with Liquid Level Controller.

High Brinell Stainless Steel

R-S Products has now perfected a method of bringing Stainless Steel castings and bar-stock to a hardness as high as 1100 Brinell. The process is effective on any Stainless Steel not exceeding 8% nickel content. This includes all of the 400-series, as well as Types 302-304 and 303 (18-8 and 18-8S) in the lower range of nickel content. There is no limitation on chrome content.

Since the normal Brinell on these steels at room temperature runs from 140 to 200 it is apparent that a tremendous step has been made in combining the corrosion resistance of Stainless Steel with the hardness necessary to tolerate abrasive materials in flow at high speed.

The following table shows the results of rigidly supervised tests on various metals:

Material	Brinell 70°F.	Brinell 1000°F.	Brinell 1100°F.
18-8 Stainless untreated	170	140	121
Stainless Iron	302	190	155
#6 Stellite	390	270	250
60 Carbon Stainless	514	420	200
R-S treated Stainless	1050	710	540

That's hard, brother!

The new-processed Stainless Steel machines and assembles to advantage.

R-S is now making 3" Butterfly valves using the new Stainless Steel for body and vane, with stellited shafts. They are being used with great success where abrasion, corrosion, and high velocity in combination are the condition to be met.

Complete R-S Valve Installation Data

Engineers like the complete dimensional data supplied for R-S Butterfly Valves. Dimensions are tabulated by standard sizes under stock types and identified by letters corresponding to detailed drawings which accompany the tables. Six full pages of R-S Products' Catalog No. 14-B (copy on request to R-S Products Corporation, Wayne Junction, Philadelphia 44, Pa.) are devoted to this basic installation data.

JMLco P-C-2

Test Methods for R-S "A" Metal

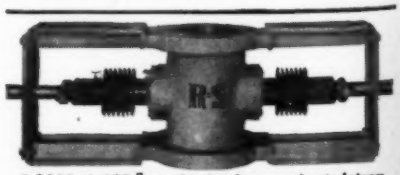
R-S Products engineers have developed their "A" Metal for resistance to abrasion, corrosion, and cavitation. As a comparative test, pieces of several metals are secured in a test section and revolved at 20,000 RPM under the impact of a 3/32" jet of water at extremely high velocity. 160,000 impacts are assumed to simulate years of extreme service. Following the test-run, the pieces are weighed, loss of weight being taken as a measure of abrasion, erosion, or cavitation.

A test-run on "A" Metal and two typical steels showed the following weight-loss:

.4 Carbon Steel.....	1.0%
18.8 Stainless Steel....	.7%
R-S "A" Metal.....	.79%

It will be seen that "A" Metal makes a very good showing in comparison with the finest of steels; a conclusion which is heightened in interest by the fact that "A" Metal is far less expensive than the other metals tested.

In actual use of "A" Metal as a material for an R-S Butterfly Valve, the loss of weight is markedly less for there is no "jet" effect in an R-S Valve. The design of the butterfly vane is such that even abrasive semi-solids "fan out" on the downstream side as the vane approaches the closed position.



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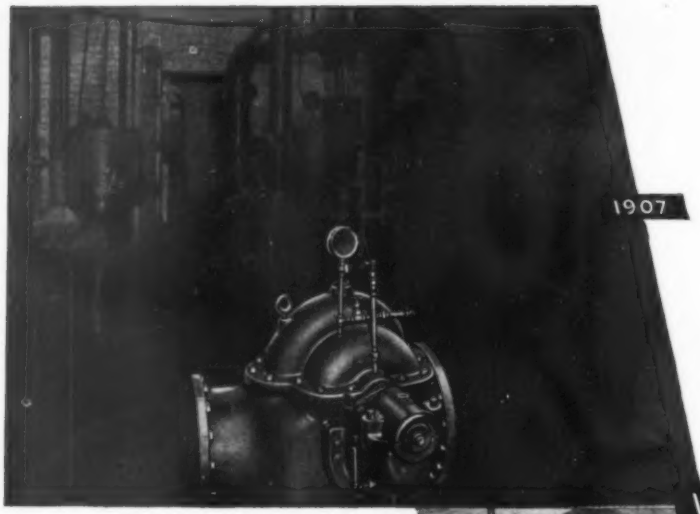

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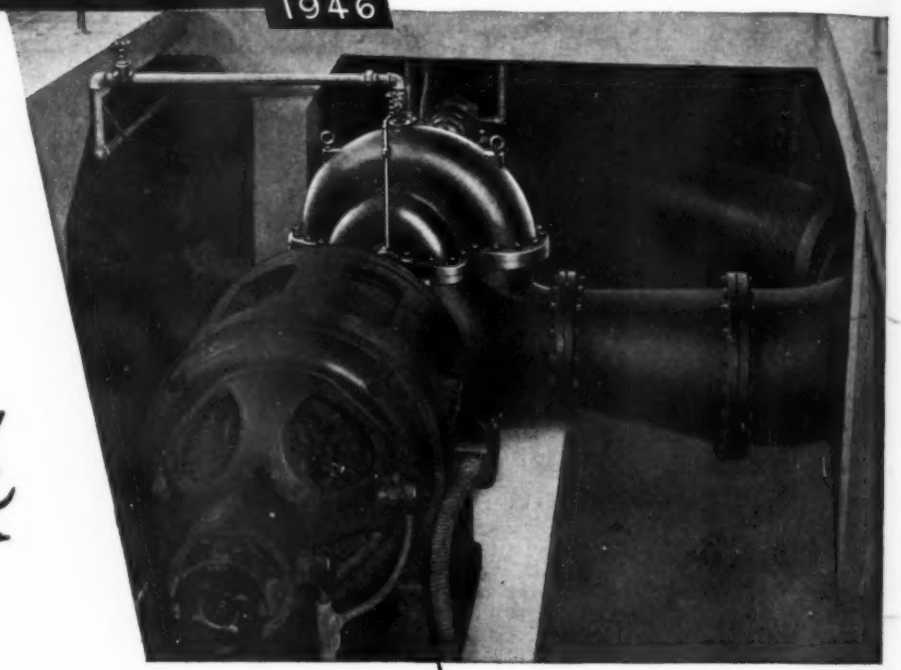

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Supervisor, Sewage Treatment Wks., Fort Jackson, S. C.

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WATER & SEWAGE WORKS

VOL. 94, NO. 3 MARCH, 1947

A Gillette Publication

GAS ENGINE MAINTENANCE AND OPERATION

Experiences of the Peoria Sanitary District

By L. S. KRAUS
Chief Chemist
PEORIA SANITARY DISTRICT
PEORIA, ILL.

The Author

IN 1935 the Peoria Sanitary District installed a gas engine-driven generator and a gas engine-driven blower in order to make effective use of the sewage sludge gas produced at the plant. The gas, a mixture of carbon dioxide and methane containing about 100 grains of hydrogen sulphide per 100 cubic feet, has a net calorific content of approximately 600 Btu. per cu. ft. The hydrogen sulphide is removed in iron oxide purifiers (gas scrubbers) to a concentration of less than 20 grains per 100 cu. ft. and the resulting gas is delivered to the engines at 5 inches of water pressure. Pressure is controlled at a relatively constant value by a 50,000 cu. ft. gas holder floating on the line.

The power plant consists of two engines, one of 300 hp. rating driving a 200 KW. generator, and the other of 535 hp. rating driving a Roots-Connersville blower discharging 12,600 cu. ft. per minute at 327 rpm.

The generator engine is a Worthington 5 cylinder unit of 12¼ inch bore and 14½ inch stroke rated at 300 hp. at 69½ lb. mep. and 400 rpm. It is equipped with separate force feed lubrication on the liners and two spark plugs per cylinder each fired by a separate magneto. The air to the mixing valve is filtered through air mat filters. This unit operates at about 75 per cent load most of the time.

The blower engine is a Worthington 6 cylinder unit of 15 inch bore and 17½ inch stroke rated at 535 hp. at 69½ lb. mep. and 327 rpm. It is equipped the same as the generator engine with respect to features of lubrication, ignition, and air filtering. This engine operates at practically full load torque and speed for a very large part of the time.

Each unit is equipped with pressure and temperature safety devices on both the oil and water system, and in addition is protected with automatic over-speed safety control. The engines are designed for continuous operation. The cylinders are of the replaceable liner type, equipped with positive force feed lubricators. In both engines the pistons which are not oil cooled are provided with four compression ring grooves, one drilled oil groove above the wrist pin, and one undrilled oil ring groove at the bottom of the piston skirt. The piston is undercut below the bottom ring groove. The sump for the engine oil circulating system is formed in the base of the engine crankcase. Oil is pumped by a gear pump directly connected to the crankshaft. Main and crankpin bearings are of the tin base babbitt type; wrist pin bearings are hardened steel pins operating in bronze bushings.

The installation has no standby equipment other than electrical equipment operated by power purchased from the local power utility. It is therefore necessary that the equipment operate for as much of the time as possible.

A program of maintenance has been adopted to reduce engine outage to a minimum and operate with safety regarding accidental shutdowns. These engines have been in operation over ten years. Rather complete data on their operation and maintenance have been kept and the following information represents averages over the ten year period.

Maintenance Program

Routine engine overhauls are scheduled at six month intervals of continuous operation, but occasionally excessive oil consumption or excessive blow-by has caused the overhaul to be undertaken before the six month period has expired. Short shutdowns to change crankcase oil, repair water leaks, inspect newly installed bearings and replace an occasional faulty spark plug or valve are infrequent necessities.

The six month overhaul includes the following:

Cleaning pistons and rings
Measuring piston and liner diameter
Measuring piston ring dimensions and replacing rings when necessary
Determining and adjusting main and crank pin bearing clearances
Measuring wrist pin bearing clearances (yearly)
Inspecting exhaust and intake valves and replacing when necessary
Inspecting and resetting gaps of spark plugs
Inspecting cam shaft gears and other drive gears
Cleaning cam followers and follower guides

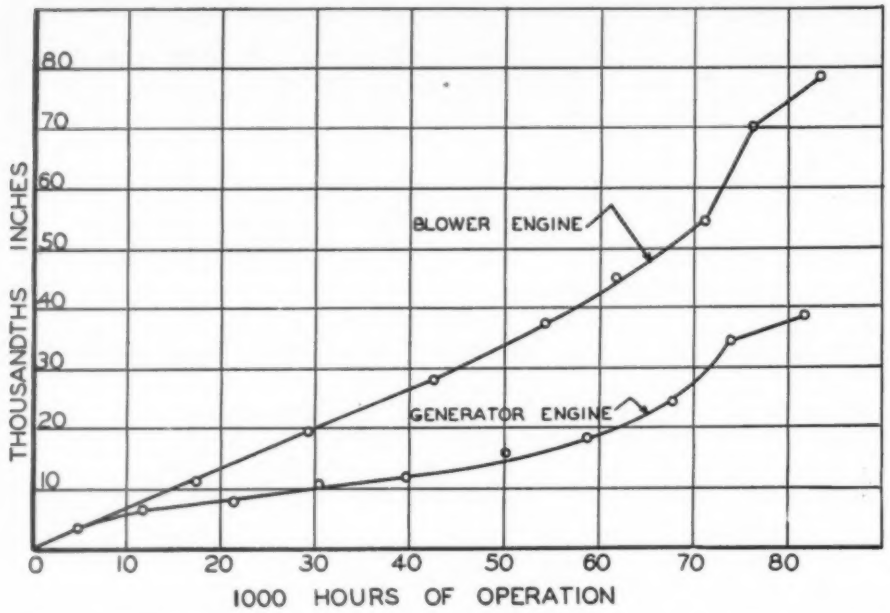


Fig. 1. Increase in Liner Diameter for Both Engines During 10 Year Operation Period

Inspecting and replacing worn governor parts
Checking magnetos and replacing one magneto with spare
Checking safety devices
Cleaning oil cooler when necessary
Cleaning oil lines when necessary
Cleaning oil pumps when necessary

Lubricating Oil

The first important operating problem encountered was in the selection of a proper lubricating oil for the circulating system. The engine manufacturer's specifications on oil were quite broad and the oil supplier recommended an extra heavy turbine oil for use in the circulating system and on the liners. It soon developed that the viscosity of the oil used was increasing with great rapidity; in one instance from 625 sec. S. U. at 100° F. to 1400 sec. S. U. at 100° F. in 30 days of use. The reason for the increase was not clearly ascertained, some persons holding that the oil was not a "straight run" oil but a mixture of a very low and a very high viscosity oil and that the low viscosity oil vaporized. Others believed that rust and other metallic oxides in the newly erected system acted as catalysts to cause polymerization of some of the hydrocarbons present in the oil.

After experimenting with turbine oils of various viscosities it was found that a heavy grade "straight run" oil was satisfactory. The viscosity of the oil increased slightly, but remained practically constant after about two weeks of operation.

Due to ring sticking problems on the fully loaded blower engine a so-called "detergent" type of oil was found to be of benefit for the force feed lubrication of the liner.

The oil used in the liner lubricator of the generator engine is the same as that used in the sump circulating system.

The lubricating oil purification system originally consisted of batch centrifuging. The oil in the engine sump was allowed to increase to about 0.75 per cent solids insoluble in petroleum ether. The batch was dumped and centrifuged to a minimum solids content of approximately 0.15 per cent. The batch was again reused and the cycle repeated until the neutralization number increased to about 1.0 milligram KOH per gram. The oil was then discarded.

The oil purification system was then changed to that of continuous centrifuging on the larger engine, which runs continuously at practically rated full load torque. The amount of makeup oil required by this engine was added as new oil to the sump of the smaller engine, which required practically no sump additions, and an equal amount was withdrawn and added to the sump of the larger engine. The turnover in the sump of the smaller engine was about a 10 day period. This operation kept the oil in both engines in as good condition as the centrifuge could provide and eliminated the need for shutting down either engine for changing the oil.

During the period of using this system a batch purifier employing bentonite as an adsorbent and a continuous bypass filter using a prepared Fullers earth as an absorbent were tested. Each of these were found to have certain disadvantages for our particular situation and a cotton waste type of continuous bypass filter was tested and finally installed on each engine. In addition to this, the centrifuge operated on continuous bypass operation for the purpose of removing small amounts of water present in the oil due to blowby.

This system of oil purification is in use at the present time. It is the practice to dump the oil batch after about 2500 hours of engine operation. This is done to eliminate the tendency of the oil to deposit a varnish-like compound on the engine surfaces. It is our observation that if a batch of oil is retained in the system for too long a time the varnish effect will be encountered. This effect was first observed during the tests of the adsorptive type of oil purifiers.

The tendency for solids to accumulate in oil coolers and oil lines seems to persist despite the continuous clarification of the oil. Oil cooler tube bundles are cleaned periodically when the temperature differential between the influent and effluent oil is decreased so that the oil to the lubrication system is above 140° F. This is accomplished by boiling the tube bundle in a trisodium phosphate solution and then blowing the space between the tubes with air carrying kerosene. The cleaning of oil lines is done periodically, but an annual inspection of these lines is considered necessary.

At the present time a detergent type of oil is being used for both the bearing and liner lubrication on the blower engine. The efficacy of this material for lubrication of this engine has not yet been determined.

Oil consumption is to a large degree a matter of piston and piston ring design and piston ring cleanliness. It is also effected by engine speed and cylinder mean effective pressures. Oil consumption data on the two engines is as follows:

Year	Rated BHPH per gal. Generator Engine	Blower Engine
1937	5040	3840
1938	7080	4630
1939	5620	3020
1940	4190	2340
1941	4230	3170
1942	4830	3870
1943	4480	4180
1944	3470	3590
1945	3330	4670

The engine manufacturer guaranteed 3000 rated BHPH. per gal. at the time of purchasing the equipment. It will be noted that the generator engine was consistently above that value and that with the exception of one year the blower engine was above the guarantee. The blower engine, running continuously at

rated full load torque experienced a sharp increase in oil consumption as the wear of the liners increased. In 1941 a change in oil control ring design corrected the difficulty and reestablished normal oil utilization. Note that the partially loaded generator engine had a much lower oil consumption than the fully loaded blower engine.

Piston Rings

The choice of piston rings is an important factor in maintaining continuity of operation and reasonable rates of liner wear and oil consumption. The purposes of the rings are three-fold:

First to provide an automatically adjustable bearing surface against the liners so that the gases in the combustion zone will be sealed in the space between the head and the piston and not blow by the clearance between the piston and the liners. Toward this end, four piston rings are provided in the piston area above the wrist pin on these engines. These are either angle cut rings with about a 1/16 inch gap or step seal rings with the gas so designed as to provide an overlapping joint which affords a measure of sealing at this point. In some cases it is desirable to use a two piece ring which is designed to eliminate the ring gap. In addition these rings may be provided with means for rapidly conforming to the irregularities in the liners, such as rings provided with a tapered face, or soft metal inserted rings which project several thousandths inches beyond the ring face, or rings plated with tin. All of these provide a high rate of wear in the initial run-in period and permit rapid ring seating.

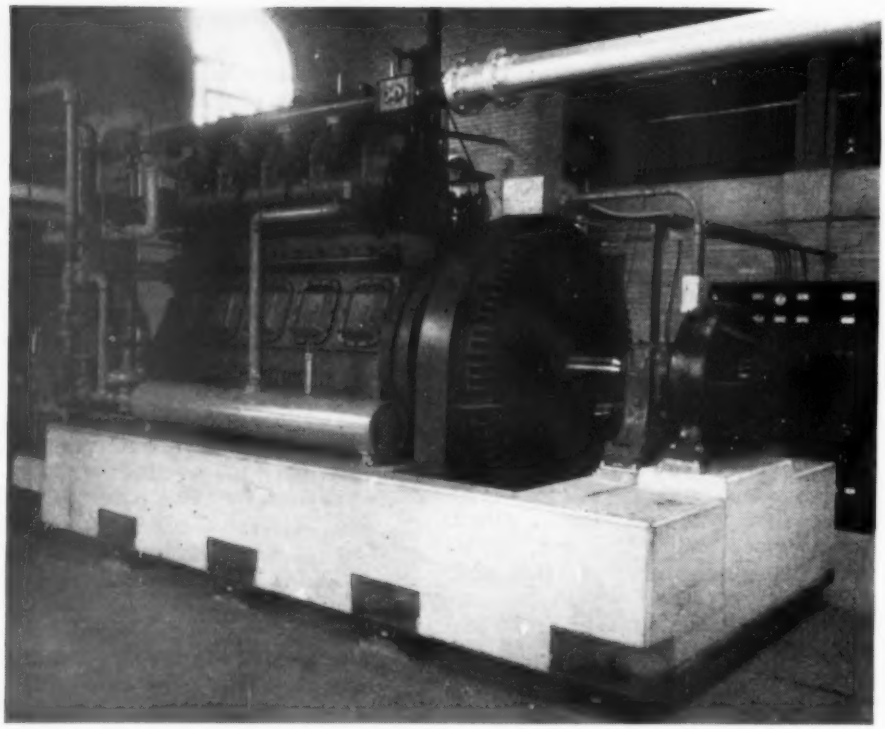
Second, to provide as much heat transfer from the piston to the water cooled liner as possible. In order that this heat transfer be effective, the ring must be free in the groove and must afford a reasonable contact area to the oil film on the liner. As far as we are able to determine, the matter of heat transfer is not a sufficiently important factor to cause ring designers to go to special rings to better accomplish this end. It is most important, however, that the rings remain free in the grooves, otherwise the loss of heat from the piston will be impeded and the resulting higher piston temperature will cause additional ring sticking due to oil carbonization.

Third, to afford a means of preventing oil which is thrown against the liner by the bearing lubrication splash from entering the compression ring zone in excessive amounts. To accomplish this, these engines are provided with two oil control rings, one above the wrist pin and one near the bottom of the piston skirt. The ring groove above the wrist is provided with drain holes to the back of the piston and the ring used in this groove may be of the slotted type with one or two bearing surfaces, or the single bearing surface ring with milled sections in the bottom which afford oil passage. The principle behind the design of oil control rings is to obtain the proper pressure against the oil film on the liner with a relatively sharp scraping surface without completely removing the oil film. The more of such surfaces provided the more effective will be the oil removal. Bearing pressure is controlled by providing small bearing areas, and in some cases by increasing ring tension with springs installed in back of the ring.

No particular difficulty due to ring sticking, excessive oil consumption or blow-by was encountered on the 12¼x14½ in. partially loaded generator engine; however, the 15x17½ in. fully loaded blower engine presented considerable trouble in each of these phases of ring application. It is now considered that these troubles were due to a combination of choice of oil, choice of ring type and increasing difficulties brought on by liner and piston wear. Attempts to correct the difficulties by experimenting with different types of rings have led to the following conclusions:

1. Step seal compression rings are more satisfactory than angle cut compression rings.
2. Two piece compression rings are very satisfactory in the third and fourth groove.

Sewage Treatment Works—Greater Peoria Sanitary District



Worthington 300 hp. Engine Direct Connected to 200 kw. "GE" Generator

3. Bronze inserted compression rings are not desirable in this particular installation.
4. Tapered face compression rings are of some value in causing rapid conforming of the ring to the liner.
5. Single or double bearing surface slotted oil control rings are very satisfactory in the oil ring groove above the wrist pin. The double surface ring gives more effective oil removal.
6. Oil control rings with milled bottom areas are not satisfactory in the oil ring groove above the wrist pin.
7. Single surface oil control rings are satisfactory in the ring groove at the bottom of the piston skirt.
8. Spring reinforcements in back of oil control rings is unsatisfactory due to spring failure.

At the present time the use of step seal rings in the compression ring grooves, a double surface slotted oil ring in the drilled oil groove above the wrist pin, and a beveled and grooved oil ring as a bottom oil control ring is considered a satisfactory combination. Oil control is very good, although none of the ring combinations tried have corrected a condition of abnormal blow-by. It is our opinion that, given a reasonable condition of oil consumption, ring sticking is largely a matter of the use of a proper oil for liner lubrication, provided that ring clearances are adequate.

When rings are installed in a piston it is well to champfer the edges to reduce the tendency to slough off metal particles. Rings should be measured at several places for radial thickness before installation and again at each overhaul. Experience indicates that 15 in. diameter rings may be reused until the radial thickness decreases about 0.020 in. It is desirable to return each ring to the same piston ring groove from which it was taken, and also to change as few rings as possible. With this rule for discarding rings, we have never observed a piston ring that failed due to loss of tension alone. It appears that loss of tension is due to overheating, and this should not occur in a properly lubricated engine.

Piston ring life on the generator engine is in the order of 24 months while on the blower engine it is about 17 months.

Liners

Liner wear is closely allied with piston ring operation. In order for liner wear to be a minimum, rings must be free and a minimum of carbon and metal particles must be present. This condition can be brought about by the selection of proper piston rings and lubricating oil, providing reasonable mean effective pressures are maintained. High rates of liner wear are observed during periods of extensive ring sticking. During the period of the use of bronze inserted rings a very high rate of liner wear was observed.

Measurements of liner wear were determined by measuring liner diameters at three points in the liner: The point opposite the second ring groove when the piston is at upper dead center, the center line of the wrist pin when the piston is at upper dead center, and between No. 4 (compression ring) and No. 5 (oil ring) when the piston is at lower dead center. Thus the upper measurement is taken in the zone of greatest wear where the No. 1 compression ring bears on the liner under high temperature and poor lubrication. The lower measurement is taken in the zone of good lubrication where only the two oil rings bear against the liner.

Fig. 1 indicates the maximum rate of increase in liner diameter for both engines during the ten year period. The data for these curves are shown in Table I. It is noteworthy that the rate of liner wear on the generator engine has been low. The value for 81,736 hours of operation of the maximum rate of increase in liner diameter as determined at the upper transverse dimension is 0.00048 inch per 1000 hours of generator engine operation. This engine has operated largely at three-fourths load and piston rings have been continuously free in the grooves. In addition blow-by has not been a problem.

The rate of liner wear on the blower engine has been considerably higher than on the generator engine. The maximum rate of increase in liner diameter for the 83,691 hours of engine operation at the upper transverse dimension is 0.00093 inch per 1000 hours, or about twice the rate of wear as that of the generator engine. This is in part due to the fact that this engine is always operating near maximum rated mean effective

TABLE I
Maximum Increase in Liner Diameters

Generator Engine		Blower Engine	
Hours of Engine Operation	Maximum Increase (Inches)	Hours of Engine Operation	Maximum Increase (Inches)
4,775	0.004	4,886	0.005
11,519	0.007	11,705	0.009
21,265	0.008	17,409	0.011
30,928	0.011	29,284	0.019
39,551	0.012	42,562	0.028
50,033	0.016	54,225	0.037
58,640	0.018	62,837	0.045
67,591	0.024	71,202	0.055
74,131	0.035	76,323	0.070
81,736	0.039	83,691	0.078

pressure and for long periods at maximum rated speed. It is also due to inability to properly solve the problem of oil control, ring sticking and blow-by. Experiments with equipment needed for operation are necessarily slow and inconclusive, particularly where more than one variable is apt to be changed during a given test period. High rates of wear are noted during periods of ring sticking and usually following the installation of a set of new rings. It appears that the rate of liner wear tends to increase somewhat as a liner becomes more worn. This is probably due to the increase in rate of blow-by which accentuates the difficulty of proper lubrication.

As liner and piston wear increases, the tendency for the piston to slap becomes more pronounced. The slap is apparently caused by excessive clearance between the liner and the piston and is evidenced by a reversal of the piston thrust from one side of the liner to the other producing a sharp noise and in bad cases a sufficient blow against the side of the liner to endanger the lubricator connections to the liner. It is rumored in the engine field that liner replacement is not necessary until liner wear is of the order of 0.010 inch per inch of piston diameter. At Peoria it was necessary to replace the liners of the blower engine when the maximum wear was about 0.005 inch per inch of liner diameter.

Bearings

At each six month overhaul the main and crank pin bearings are inspected and the clearance determined. The clearance on the main bearings is determined by the lead or fuse wire method. The main bearing cap is removed and fuse wire of 0.010 inch diameter is placed circumferentially on the journal at two, three or four points, depending on the bearing length. The cap is replaced and the bolts drawn tight. The cap is then removed and the compressed wire is measured with a micrometer caliper. The thickness of the wire is approximately the bearing clearance. Care must be taken to replace the bearing cap so that it is exactly centered on the journal. To accomplish this guide shims are inserted between the cap and the recess in the frame in which the cap sets. If necessary, the clearance is adjusted either by scraping the cap or removing shims from under the cap. It is imperative that the clearance be redetermined following each adjustment.

Shims should be inspected after installation to make certain that the clearance between the shim and the journal is not excessive. Large gaps at this point permit the loss of much oil and reduce the oil pressure to the crankpin bearings and wrist pins.

When tightening main bearing cap nuts, care should be taken to tighten them gradually so that uniform pressure may be exerted over the cap casting.

Where shell inserted main bearing caps are used, the shell must not project beyond the face of the cap flanges.

The crankpin bearing clearance is determined by the insertion of feeler gages through the full length of the bearing. Adjustment of crankpin bearing clearance is usually accomplished by insertion or removal of shims.

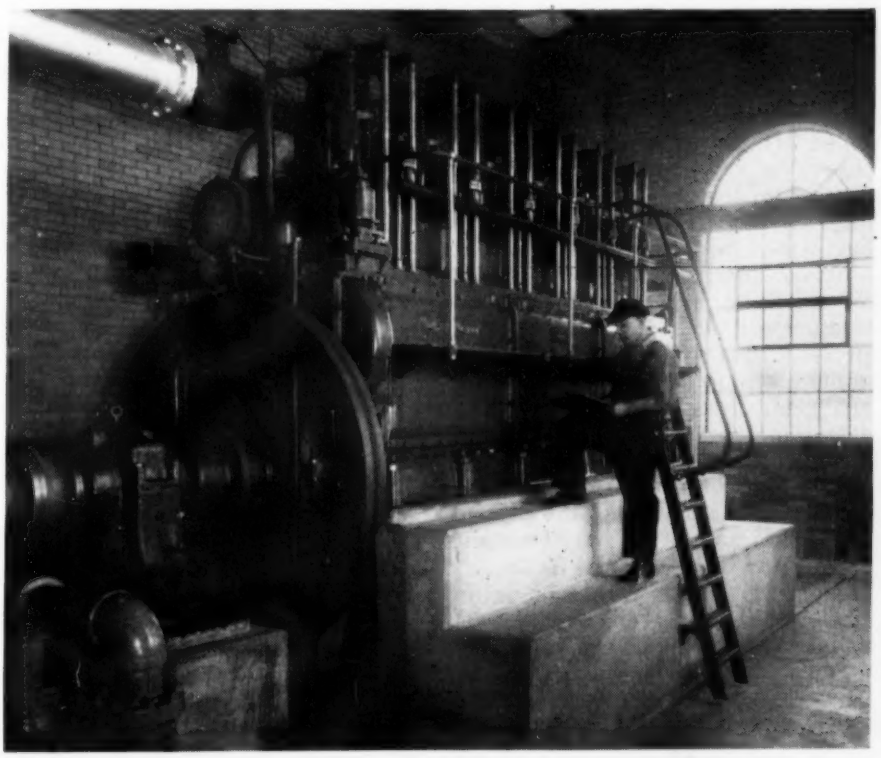
Wrist pin clearance is determined each year by removing the pin from the piston and inserting feeler gages through the full length of the bushing. Determining wrist pin clearance by measuring pin and bushing diameters by the micrometer caliper is entirely unsatisfactory and must not be used. Wrist pin clearance is reestablished by grinding the pin to a highly polished surface and installing a new wrist pin bushing in the eye of the connecting rod. The bushing is prepared to exact outside diameter and approximate inside diameter and is cooled in dry ice and inserted in the eye of the connecting rod. After it reaches room temperature it is reamed or scraped to provide the proper clearance and uniform bearing over its entire area.

In general few bearing difficulties have been experienced on these engines. Bearing troubles have come about due to checking and melting of the babbitt and have been confined to such small areas of the bearing that they have not caused the crankshaft to be unsupported. Where checked sections have come loose the bearings were replaced only if the loose section was near either end or adjacent to the oil groove. Otherwise the bearing is kept in service. Small melted areas have been repaired by filling with molten babbitt and relieving this section by scraping so that it does not bear on the journal. Most of the bearings replaced were main bearing caps. In no instance was the crankshaft journal scored by bearing troubles.

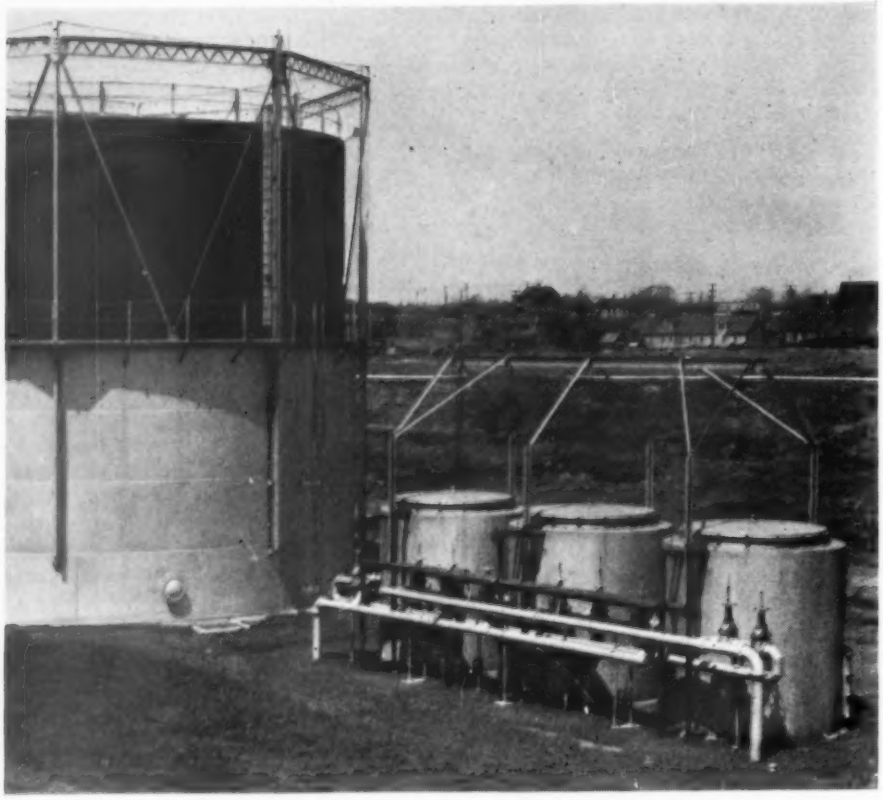
Crankshaft deflection as indicated by a sensitive indicator supported between the crank webs is determined before and after each overhaul. Thus far it has been unnecessary to adjust engine main bearings to reduce crankshaft deflection. It has been necessary to adjust outboard bearings to bring the deflection under the value recommended by the engine manufacturer.

Intake and Exhaust Valves

Intake and exhaust valve problems have been minor but persistent.



Worthington 535 hp. Engine Direct Connected to Roots-Connersville 12,600 cfm. Blower



50,000 cf. Gas Holder and Scrubbing Units
These purifying units, filled with iron oxide sponge, reduce hydrogen sulphide from 100 grains per 100 c.f. to a 20 grain gas.

When the engines were purchased they were equipped with cast iron valve cages and valves of cold rolled steel stems with cast iron heads. These valves gave and are still giving excellent service as intake valves but were not entirely satisfactory as exhaust valves. In the latter service the valve head seats wore and pitted excessively, thus reducing the valve life, and the cold rolled stem corroded and eroded considerably just above the valve head where it was exposed to the hot exhaust gases at high velocity. In addition valve cage guides and seats wore considerably.

These difficulties were somewhat corrected by using valves of austinetic steel heads and stainless steel stems. Cages were modified to take guide bushings of nitrited cast iron and manganese bronze, and replaceable cast iron seats were installed. These changes provided much better operation but did not eliminate exhaust valve troubles. At the present time corrosion of valve stems and rapid wear of valve seats is largely eliminated; however, the stainless steel valve stems are found to warp unduly and valve stem and valve stem guide wear is a problem. This does not take place in all of the exhaust valves but it does necessitate occasional shutdowns to install a spare valve. Attempts to correct this situation have been made without success. The cages have been provided with fittings for lubrication of the stems, but this has not remedied the condition. It has been observed that a certain amount of warping takes place in the valve cage and it may be necessary to prevent this before a satisfactory solution to valve warping and valve guide wear can be found.

Valve maintenance resolves itself largely into reconditioning the seats in the valve and in the cage. This is done by grinding the valve against the seat with abrasives when the wear and pitting is slight. When this method cannot be employed, the valve and seat are ground separately in a lathe with an accurate high speed carborundum wheel and then finally lapped against each other with a grinding compound. Valve seats are tested with prussian blue paste before placing them in service.

To correct for cage warping the seat is checked against the valve stem guide. If the seat plane is not perpendicular to the guide axis, it is made so by grinding. Since exhaust valves are water cooled, occasional inspection of the water jacket for scale deposits is desirable. When these deposits are appreciable the valve cage jacket is filled with muriatic acid, which dissolves the scale. Where frequent treatment is necessary, corrosion inhibitors must be added to the muriatic acid. A clean water jacket insures lower valve operating temperature and reduces a difficult maintenance problem.

The care of intake and exhaust valves cannot be over emphasized. In order that engine operation be efficient, these valves must be in practically perfect condition. Fuel economy and ability to carry load are closely related to valve operation and effective valve seating. Valve operating mechanisms are checked at each overhaul. Cam followers are kept free in the guides, rocker arm mechanism bearings are inspected and replaced when necessary, and clearance between the valve stem and lever arm are maintained at the proper value. Valve stem clearance is checked at least every 100 hours of engine operation. A mixture of light oil and kerosene is applied to the top of the valve stems three times each day.

Ignition System

The ignition system used on these engines consists of two magnetos firing two spark plugs in each cylinder. High tension distribution is employed.

Magnetos are of the rotating magnet-stationary coil type and are equipped with impulse couplings which provide high voltages during low speed starting. Magneto maintenance is scheduled for replacement of one magneto each six months. Thus each magneto is in operation for one year before overhaul. Maintenance consists in cleaning the unit and replacing fixed and rotating high tension electrodes when necessary. The gap for these electrodes is adjusted to approximately 0.010 inch. Low tension breaker points are adjusted each year and replaced when necessary. Bearing replacement is occasionally required.

Spark plug problems on these engines were largely solved by the use of a plug developed for this purpose by the Champion Spark Plug Co. The plugs now in use have an average life of about 11,500 operating hours and do not require gap adjustments more frequently than every 2000 operating hours. When removed from the engine, spark plugs are adjusted to 0.015 inch gap. It is considered satisfactory to allow the gap to increase to 0.040 inch before regapping.

Wire employed for conducting the high voltage current from the magneto to the spark plug is stainless steel heavily insulated wire with treatment to prevent insulation deterioration due to oil.

Fuel System

The fuel system consists of a gas pressure regulator, gas-air mixing valve, and governor. Little difficulty has been experienced in any of these units with the possible exception of the governor. Both the pressure regulator and gas-air mixing valve should be cleaned and adjusted yearly. The governor should be inspected at each overhaul.

Governor difficulties in the early period of operation were brought about by inadequate lubrication and by corrosion due to crankcase vapors passing into the governor housing. By changing the governor lubrication from the force feed lubricator to the oil circulating system, thus greatly increasing the feed to the unit, and by preventing the crankcase vapors from entering the governor housing, the problem was completely solved. At present governor maintenance is slight. Thrust collar bearing surfaces are covered with stellite in order to reduce the rate of wear and thus reduce frequency of replacing this part.

Lubrication System

The lubrication system maintenance has been largely a matter of cleaning. The oil circulating pump, force feed lubricator and oil lines both inside and outside the engine are inspected yearly and cleaned when this is considered necessary. Check valves on liner lubricator lines are cleaned at each overhaul. The cleaning of the oil cooler has been described under the section on lubricating oil. The linkage mechanism for driving the force feed lubricator should be checked and repaired when necessary.

Water Circulating System

The water circulating system on these engines consists of an electrically operated centrifugal pump which discharges the water through cooling piping and thence to the engine water jackets. Since the cooling system is not of the evaporative type, the tendency for scale formation is greatly reduced. The water used for make-up is partially softened by cold lime-soda treatment. Some scale does form on the water jackets, particularly on the upper few inches of the liner and in the exhaust manifold. These deposits, which attain a depth of about ⅛ inch, are removed every two years by mechanical means or treatment with muriatic acid.

Air Starting System

The air starting system consists of a two stage air compressor, air tanks, air starting valves operated by camshaft controlled push rods and air starting check valves.

Difficulties with these units have been minor. The air tanks are provided with a separator for removing water continuously and in addition a blow-off valve is installed in the air line to the engine for removing any water accumulation in the piping and tanks not taken care of by the separator. The system is blown off for a short time before starting the engines.

The sealing of air starting valves and check valves must be maintained by occasional grinding of the valves against the valve seats, and the seal between the check valve and the head must be perfect in order to prevent exhaust gas from passing through these valves during normal engine operation. If the exhaust gas is allowed to flow through the air starting system, the valves will become corroded and will not be fit for use when needed. Air starting check valve springs must provide sufficient tension to prevent the valve from opening on the intake stroke.

TABLE II

Summary of Engine Operation

	Blower Engine	Generator Engine
Total hours of engine operation	83,353	83,669
Total days since starting operation	3,652	3,652
Average hours operation per day	22.8	22.9
Oil consumption rated BHPH per gallon	3,550	4,480
Speed—% of rated maximum speed	90.9	.....
M.E.P.—% of rated M.E.P.	97.0	68.5
Fuel consumption—BTU/BHPH	9,650	.....
Fuel consumption BTU/Delivered KWH	.....	16,200

Operation

In general engine operation has been most satisfactory. The engines are under constant surveillance of an operator. Hourly readings of water, oil, and exhaust gas temperatures, together with readings of gas consumption and load, keep the operator aware of the condition of the engines and results in very few automatic shutdowns due to improper operation. Thus engine operation from the standpoint of operator's duties is largely that of inspection and lubrication with occasional need for making adjustments to insure operating continuity.

Table II is a summary of the operating characteristics for both units. The values are averages of daily data for the ten year period.

Engine outage was largely due to shutdowns for maintenance; however, some of the outage was caused by Illinois River floods and due to lack of gas. The outage due to routine overhauls is approximately eight days per year for the blower engine and six days per year for the generator engine.

The average values for lubricating oil consumption do not include batches of oil dumped but indicate the oil burned in the engine.

The fuel consumption is an estimate based on accurately measured gas volumes and on Btu. values computed from analyses of grab samples of gas collected once monthly. In the case of the blower engine the bhp. used was based on tests made when the blower was installed. The output of the generator is accurately metered.

Cost of Power

Table III indicates the net saving in operating cost to the Sanitary Dis-

TABLE III

Gas Engine Cost Data

Years of operation		10.0
Power produced		42,900,000 KWH
Power purchased		1,700,000 KWH
Power consumed		44,600,000 KWH
Cost of power if all were purchased		$468,300
Actual cost of power		55,724
Gross saving in power cost		$412,576
Cost of engine operation:		
Maintenance	$ 17,023	
Supplies	13,652	
Labor	20,480	
Total		$ 51,155
Net saving		$361,421
Total cost of gas engine installation	$106,855	
Cost of improvements	3,293	
Total capital cost		$110,148
Annual debt service on basis of 20 years and 4% interest		$ 7,820
Net cost of power:		
Cost of operation	$ 51,155	
Debt service	78,200	
Power purchased	55,724	
		$185,079
Net cost per KWH used		0.0042

trict over the ten year period of operation.

The power produced was computed by adding the KWH. generated as electrical energy to the computed amount of power which would be required to drive a motor driven blower of the same type as the gas engine driven blower. The latter quantity of power generated is a purely hypothetical value since the motor operated blower would not have the flexibility of speed control at high efficiency normal to a gas engine driven unit.

Note that the power generated is about 97 per cent of the total power used and that the net saving to the Sanitary District in annual operating cost is over $36,000.

In order to compute the actual cost of power consumed it was assumed that the capital investment would be written off in 20 years and that the interest rate would be 4 per cent. The cost of power purchased is very high due to the KVA. demand charge in the power contract. Thus the cost of about 3 per cent of the total power produced exceeds the cost of operation required to produce the remaining 97 per cent.

The cost of power used, 4.2 mills per KWH., is greater than the actual cost to the Sanitary District due to PWA assistance in the cost of the initial installation. This factor reduces the cost of power used by the District to about 3.7 mills per KWH. The cost of power produced is about 2.6 mills per KWH.

Conclusions

The maintenance program worked out has resulted in effective utilization of the gas engine installation.

The first ten years of operation have resulted in the generation of about 97 per cent of the power requirement of the activated sludge plant if the gas engine units were not installed and motor operation was used throughout.

The gas engines have operated more than 95 per cent of the time, this including all outage such as shutdown due to floods, lack of gas, etc.

Oil consumption and fuel consumption have been satisfactory.

The use of the gas engine equipment has saved the Peoria Sanitary District about $36,000 annually.

The estimated cost of power used is about 3.7 mills per KWH.

The estimated cost of power produced is about 2.6 mills per KWH.

Charles Burdick Receives ASCE Honorary Membership

At the 94th annual meeting of the American Society of Civil Engineers held in New York in January, Charles B. Burdick, Consulting Engineer of the firm of Alvord, Burdick & Howson, Chicago, was presented with honorary membership for his long service to the society and to his profession.

Mr. Burdick, a graduate from the University of Illinois in 1895, has been a member of the firm of Alvord, Burdick & Howson since 1902. Mr. Burdick's engineering activities have been concerned chiefly with water supply, flood relief, and sewage disposal. His work has been widely distributed geographically throughout more than three-fourths of the United States and in many foreign countries.

Charles B. Burdick joined the A. S. C. E. in 1905 and was a Vice-President in 1941-42. Mr. Burdick joined the A. W. W. A. in 1907 and was elected to honorary membership in that organization in 1944. He is also a member of the Western Society of Engineers and the Chicago Engineers' Club.

Virginia Wastes Disposal Ass'n Organized

In Roanoke, Va., on March 4th, a group of about 70 municipal officials, engineers and chemists, interested in sewage and industrial waste disposal and the alleviation of stream pollution, met at Hotel Roanoke to form the Virginia Industrial Wastes and Sewage Works Association, adopt a constitution, hear a technical program and elect officers.

The organization meeting was called by D. R. Taylor, recently appointed Asst. City Manager of Roanoke, Va., who served as temporary chairman during the organization meeting which was well attended by mayors, city and town managers, city engineers and engineers and chemists from Virginia's leading industrial plants.

The Virginia association becomes the 30th member association in the National Federation of Sewage Works Associations. On hand to witness the birth of the new association was F. S. Friel, president, and H. W. Wisely, executive secretary of the Federation.

The following were elected officers:

President—R. W. Digges, Gen'l. Mgr., Hampton Roads Sanitation Districts, Virginia Beach, Va.

Vice Pres.—B. L. Strother, Chem. Engr., E. I. DuPont Co., Ampthill Wks., Richmond, Va.

Secy.-Treas.—A. H. Paessler, Chem. Engr. Virginia Water Control Board, Richmond, Va.

Nat'l Director*—L. L. Hedgepeth, Exec. Engr., Virginia Water Control Board, Richmond, Va.

Ed. Note: We regret that this news item is all that could be gotten ready in time for inclusion in this issue. In our April issue will appear the customary form of illustrated account of the first meeting of the Va. Ind. Wastes and Sewage Wks. Ass'n.

*Representative on Board of Control, Federation of Sewage Wks. Assns, for 3 year term.

"Sid" Behrman Establishes Chemical Consulting Practice

A. S. Behrman, for many years Vice President and Chemical Director of Infilco, Inc., and, following his return from active military duty in World War II, Vice President and Director of Research, Velsicol Corp., announces his recent withdrawal from the latter organization and the establishment of a chemical consulting practice. Mr. Behrman ("Sid" to his many friends) will specialize in the fields of water treatment, ion-exchange processes and materials, siliceous gels and gel catalysts, and chemical patents. His new office and laboratory are at 9 South Clinton St., Chicago.

M.W.U.A. COMES OF AGE

Meets at Portland for 21st Time to Again Enjoy Famed Clam Chowder Supper

THE annual midwinter conference and exhibit of the Maine Water Utilities Assn. was held at Portland on Feb. 11 and 12. This was the 129th conference of the association and the 21st held annually in Portland.

Chairman
L. G. Smith
Supt.
Kennebunk
(V.P. of M.W.U.A.)

No. 1 Host
F. J. Reny
Gen. Mgr.
Portland
(M. C.)

Features of the meeting were the famous clam chowder supper (with "donuts") given each year with the compliments of the Portland Water District, and the exhibits of 29 manufacturers and agents (some with demonstrations). As usual the clam chowder was cooked and served by employees of the Water District and as usual, too, it was delicious, thanks to Percy H. Belger and his boys, who served more than 205 persons.

For entertainment after the supper, the Kathadin Mountaineers gave forth with their own brand of music, which is rapidly becoming a favorite with water works audiences of New England. With a "gitar," "accordeen," fiddle, and bull-fiddle, these boys can really handle a tune of any type, and if a piano is handy, the accordian player, a fellow named Dewey, "goes to town." One of the local water district boys played the harmonica, and a professional funster told a few jokes on Roger Esty, "Scotty" Marshall, and Joe Reny.

Portland Honors Its Employees

The Portland Water District has long had a practice of honoring its employees for long service by presenting 20 year service pins when the employee reaches that milestone. This year three employees reached the two decade mark and were presented pins. This brings to 35 the total number of employees who have worked 20 years or more for the Water District, and the average service of these persons has been 28½ years for a total of approximately 1000 years of service—quite a record we admit.

The Portland Water District also gave signal recognition to Superintendent **Milton Thorne** for his 45 years of service. The token of appreciation presented to Mr. Thorne by the District was a $1000 U. S. Savings Bond. The presentations were made by **Fred J. Reny**, Gen. Mgr. and Treasurer of the District.

45 Year Man
Milton Thorne
Superintendent
Portland
(45 years of service to Portland Water Dist.)

Ownership of Meters

"Should a Water Utility Own All Water Meters and Maintain Them?" was the topic of the paper presented by **George S. Wescott,** Meter Clerk Portland Water District.

Until 1921, in Portland the consumers purchased the water meters, which were then maintained by the Water Company. From that year until 1932 the Water District installed meters free and maintained them. This practice was stopped in the lean years of that decade and not reestablished until 1938, at which time it was decided that the District should own all of the meters and should obtain title to existing private meters by purchase. At that time there were 2200 customer owned meters.

In order to set a fair purchase price, the District estimated a 2 per cent depreciation and 2 per cent maintenance charge for each year of service. At this rate customers received from one to two dollars plus, depending on the size of the meter. Only four persons out of 800 so far have refused to sell the meter. For these cases the company will simply take out the old meter, leave it with the owner, and replace it with a new meter of the District's ownership. The District will continue its plan of obtaining title to all meters.

Secy-Treas.
Earle A. Tarr
Supt.
Winthrop

Editor
S. S. Anthony
Supt.
Augusta

Other Hosts from P. W. D.

Harry U. Fuller
Chief Engr.

J. A. Jackson
Asst. Treas.

E. A. Boothby
Asst. Supt.

H. B. Scales
Chemist

Chesley L. Ward
Meter Supt.

Customer Relations

J. Arthur Jackson, Asst. Treas. of the Portland Water District, told of the change in type of customer complaints since the war. Mr. Jackson believes that "war nerves and battle fatigue" have had a distinct influence on complaints in Portland.

Of particular help to the District in its handling of complaints is the "complaint diary" which lists every complaint, its date, time, type, location of complainant's service, and disposition of the complaint. This record is helpful in solving new complaints and in tracing down the causes of complaints. For example, a taste and odor problem was traced through the system by the complaint record, and in one instance low pressure and a short supply was likewise traced and the cause located by a study of the complaint record.

Probably the largest number of complaints are about bills that are too high, but there are also (believe it or not) complaints about bills too low, about noise, about manhole covers, about trenches, about a lady's heel caught in a curb box, and so forth. Most complaints about bills are caused by comparison of summer bills with winter consumption, a decidedly erroneous basis for comparison. The complaint diary helps even in these cases.

Demonstrations

On the morning of Lincoln's birthday, most of the registrants were on hand to see the demonstrations of a coal loader and of a boring machine. The latter actually ran a hole under the street for a connection to the Water District's employee's garden. This device uses a compressed air motor and water delivered to the drill point to aid in the boring and to flush out the cuttings. Holes up to eight inches are possible, the drill bits being attached to five foot sections of drill rod, which are placed in the machine when it has made its five foot travel, controlled by a hand lever working a pinion and rack gear.

Demonstrations
(Left)—Air Compressor Running Auger Under Street. (Center)—Group Watching Auger Drilling. (Right)—Group Watching Truck Loader.

Following the demonstrations, lunch was served to 184 persons by the ladies of one of the local churches. Turkey and the trimmings, with home made pie, were the delights to the palate.

Fire Protection Costs

The afternoon session was presided over by **L. G. Smith,** Supt., Kennebunkport Water Utility, and Vice Pres. of the M. W. U. Ass'n., and the legislative committee report was given by John P. Carey, who explained two pieces of legislation now up for consideration by the Maine legislature.

Maine Clam Chowder!
The Steaming Kettles—The Gleaming Bowls—The Waiting Tables.

Harry U. Fuller, Chief Engineer of the Portland Water District, presented three means by which one could arrive at "The Annual Cost of Fire Protection." One may develop a theoretical relationship from a tabulation of the individual costs of fire protection service and the total cost of service. One may also use a curve giving the relationship of the per cent of the total cost attributable to fire protection plotted against the number of services (estimating 4½ persons per service), or one may use a series of curves showing the cost of fire protection plotted against the number of services for different rates of hiring money. All three of the methods appear applicable.

Cost of Machine vs. Hand Construction

Raymond Moore, Asst. Engr. of the Portland Water District, showed figures on the "Savings in Construction Costs by the Use of Machines." Mr. Moore was speaking in particular reference to trenching necessary for main laying. His observations were summarized in the accompanying table.

In the round table which followed Mr. Moore's paper, **Sydney S. Anthony,** Supt. of Augusta, Me., Water Utility, said that a trencher obtained from the War Assets Adm. had saved them 54 cents per foot over hand trenching costs, and in one summer season had saved one-third of the cost of the machine. Rates of trenching varied from 14 to 300 ft. per hour, depending on soil conditions encountered.

Roger Esty, Supt. of Water and Sewers at Danvers, Mass., corroborated the savings possible by machine trenching, but suggested that best and most economical results were obtained when the machine was not operated at maximum speed. One advantage of machine trenching is that one end of the trench is ready for the pipe laying crew soon after the trench is started and this speeds the operations.

Constr.	Total Feet	Total Cost	Cost per Foot Max.	Min.	Avg.
Hand	3634	$3,516	$1.49	$0.60	$0.968
Machine	5502	4,116	1.05	0.45	0.718

Fred J. Reny, Gen. Mgr. of the Portland Water District, cited many more examples of the advantages of machine over hand labor. Mr. Reny

Clam Chowder Supper!
Two Bowls, Donuts, Pie, Cheese and Coffee! Who Could Ask for Anything More!

also explained the card index and record system of office on these main laying jobs. In determining the cost of any operation, a 20 per cent overhead is added on labor and a 10 per cent overhead charge is added on materials. These values just about determine the actual cost of the construction. The 20 per cent and 10 per cent values were determined by trial and error after several years' experience.

At the close of the meeting, when Mr. Anthony explained the need for scrap metal, Mr. Reny remarked that the price of scrap iron today is approximately the same as the cost of cast iron pipe 25 years ago. (G.E.S.)

Maine Superintendents in Evidence

Maurice Libby
Bath

J. A. Randlette
Richmond

F. L. Hatch
Kittery

A. F. McAlary
Rockland

Herb Hudson New Chief Engineer Illinois State Water Survey

Herbert E. Hudson, Jr., formerly Filtration Engineer at Chicago South District Filter Plant, has been appointed Chief Engineer of the Illinois State Water Survey at Urbana, Ill.

Mr. Hudson replaces Charles O. Reinhardt, who resigned to accept a regular commission as a Commander in the Navy. Hudson is no stranger to the Illinois Water Survey, having studied there as an undergraduate engineering student, and having worked there on an engineering research project during the war. His background in water works design and operation makes him well suited to assume the duties and follow in the footsteps of such well known men in the sanitary engineering field as Paul Hansen, G. C. Habermeyer, and W. D. Gerber.

Hudson is well known to water works men in the State of Illinois, having served as an energetic secretary of the AWWA Illinois Section for several years.

Needed Research

Very much needed is a practical economical method for the effective treatment or disposal by reclamation or otherwise of wastes from the thousands of small meat slaughter houses scattered all over the country.

Toward this end we understand that an arrangement has been made between the Pennsylvania State Sanitary Water Board and Penna. State College where studies are to be made looking toward the development of methods of utilization and/or treatment of wastes from the state's many small slaughter houses. This research project constitutes a part of the drive by the State Sanitary Water Board to clean up stream pollution in Pennsylvania.

Prices on Water Works Material

By John E. Hubel
Milwaukee, Wis.

As in other municipalities, the city of Milwaukee has had to pay considerable increases in the prices for water supply materials in 1946 as compared with those paid two to four years ago. Here are some of the prices the Milwaukee purchasing agent had to pay in May, 1946, compared with those paid for the same materials in former years:

Prices Paid for Water Supply Materials by City of Milwaukee

	May 22, 1946	Previous Price Year	Previous Price
2 " gate valves (dbl. hub)	$ 11.40	1943	$ 8.60
3 " gate valves (dbl. hub)	15.00	1945	10.35
4 " gate valves (dbl. hub)	19.10	1945	13.10
6 " gate valves (dbl. hub)	30.50	1945	21.85
8 " gate valves (dbl. hub)	47.10	1945	33.75
12 " gate valves (dbl. hub)	102.80	1945	73.60
3 " gate valve stems	3.05	1945	2.20
4 " gate valve stems	4.25	1945	2.75
6 " gate valve stems	8.75	1945	4.10
8 " gate valve stems	12.50	1945	7.10
12 " gate valve stems	20.00	1945	12.35
⅝" corporation stops	1.40	1945	1.24
1 " corporation stops	2.14	1945	1.90
¾" curb stops	1.26	1945	1.09
1¼" curb stops	2.76	1945	2.45
3 " dia. water pipe, class "C", BS, 12' lengths	76.20 T.	1945	68.00 T.
6 " to 16" dia. pipe, class "C", BS, 12' lengths	64.20 T.	1945	53.20 T.
6 " dia. centrifugally cast pipe, 18' lengths	.99 lin. ft.	1945	.865 lin. ft.
8 " dia. centrifugally cast pipe, 18' lengths	1.48 lin. ft.	1945	1.29 lin. ft.
Cast iron special castings, consisting of class D&C pipe sleeves, and 4-ways	192.00 T.	1942	143.00 T.
4" to 16" special castings, class "D", consisting of 3-ways, 4-ways, plugs, caps, sleeves, curves and reducers	162.00 T.	1944	120.00 T.
4" to 16" offsets	376.98 T.	1944	275.32 T.

Regarding hydrants, the city requested bids on August 6, 1946, for Milwaukee style hydrants. Only one bid was received, and the price quoted was $140.00 each, as compared to a price of $98.00 paid in October, 1944. This bid was rejected due to the great increase in price. New bids were then requested on A.W.W.A. standard hydrants, which were purchased on September 25, 1946, at a price of $107.20 each.

Unique Lubricant for Sludge Pumps

John B. Kleven, Supt. of the Grand Forks, N. D., sewage treatment plant, offers a unique scheme for the lubrication of packing of plunger type sludge pumps. Says Mr. Kleven:

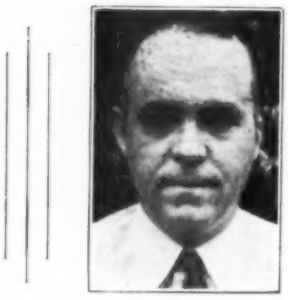
"We formerly used castor oil as the packing lubricant on our two plunger type Marlow Sludge Pumps. However, during this past year we tried liquid soap instead of the castor oil; and, in my opinion, it is by far the best lubricant that we have found for sludge pump lubrication at Grand Forks."

Cleaning Filter Sand With Sulphur Dioxide

A Recent Experience in an Eight Mgd Plant

By CLYDE F. ANGLE
Supervisor
Water Department
CELANESE CORP. OF AMERICA
ROME, GA.

THE quality of our finished product is largely governed by the quality of the water required for processing; thus it is essential that the finished water be practically free of certain minerals, microorganisms, turbidity, etc., and therefore it is our business to see that this quality is maintained in strict accordance with specifications. It will be easily understood that the raw water must be properly prepared before being applied to the filters in order to minimize filter troubles. Since filter troubles are primarily a matter of prevention, no effort is spared which would in any way improve the process of coagulation and the final process of filter washing.



The Author

Maintaining Clean Filter Beds Important

Although the water delivered to the filters has been prepared by skilled operators and filter washings have been properly executed, frequently the sand grains of rapid sand filters become coated with mud, biological slime, manganese, organic matter, iron floc particles, or a combination of two or more of these film building materials. These deposits must be removed (or the sand replaced) so that the normal quality of the finished water and filtration rate can be maintained.

In the fifteen years that the filters have been in operation at our Rome plant the sand has been treated several times with various chemicals for the purpose of removing mud balls, biological slime, manganese and iron, but never with any real success until this year, when it became necessary to either clean the sand thoroughly or replace it.

SO_2 Found Best by Test

To replace the sand was prohibitive, since the cost both in labor and material was far too great, so the problem became one of finding some chemical effective enough to loosen the coatings from the sand grains sufficiently to allow prevailing washing procedures to remove the accumulations. We found that the use of caustic soda or chlorine, which is effective in many cases, to be of little value in loosening our particular coating, which was made up largely of manganese and iron oxides. So in our case it seemed that some reducing agent should be used. With a small laboratory cylinder of sulphur dioxide (SO_2) samples of coated sand were treated. From these tests a 2 per cent solution of the gas was found to be the most economical and to give the desired results.

It is believed that sulphur dioxide solution (sulphurous acid H_2SO_3) cleans the pipe interior, the gravel and the sand in the following manner. The coatings existing on the sand were largely iron hydroxide, hydrated manganese dioxide, silica, calcium and magnesium carbonates. These are acted upon by the acid which reduces the manganese to soluble manganous salts and the ferric iron to soluble ferrous iron.

By oxidation, sulfuric acid is formed to some extent from the sulfurous acid. The acid dissolves or loosens the incrustants, breaks apart agglomerates, scours the gravel, and unplugs collector pipe orifices that may be partially closed.

It is known that sulphur dioxide (SO_2) gas must be respected and handled with reasonable caution. All pipe connections must be kept tight. The gas is irritatingly unpleasant and can be toxic. A gas mask equipped with an "acid" gas canister is good protection to have at hand in case of an excess of gas. The liquid striking moist skin may cause a "frozen burn" from the resulting quick evaporation.

It is believed that this chemical is less dangerous to handle than many other aggressive chemicals, especially sulphuric acid (H_2SO_4), sodium hydroxide (NaOH), etc.

Preliminary Testing of Filters

Each filter was analyzed for sand depth, sand expansion, filter rate, back wash rate, noting any abnormal condition such as hard and soft spots, mud balls, channeling, etc. The results were recorded as follows:

	Filter Number							
	1	2	3	4	5	6	7	8
Sand depth, inches	28	29	28	26	33	32	30	32
Sand expansion, per cent	25	20	28	19	25	19	23	25
Filter rate, gals. per sq. ft./min.	2.2	2.2	2.0	2.5	2.4	2.6	2.5	2.8
Wash water rate, gals. per sq. ft./min.	24	25	24	26	25	25	23	25
Effective size of dirty sand	.45	.43	.41	.43	.46	.50	.48	.50
Uniformity coefficient sand	1.32	1.44	1.43	1.39	1.52	1.40	1.39	1.36

Average effective size before cleaning — .46 mm.
Average uniformity coefficient before cleaning — 1.41.

A typical filter bed consists of the following:

4 inches of 2½ by 1½ inch gravel
4 inches of 1½ by 1 inch gravel
4 inches of 1 by ½ inch gravel
3 inches of ½ by ¼ inch gravel
3 inches of ¼ by ⅛ inch gravel
24 to 30 inches of sand, effective size .38 to .42, and a uniformity coefficient of 1.50 or slightly less.

The "effective size" can be defined as the theoretical size in millimeters of a sieve that would pass 10 per cent of the sand. The uniformity coefficient is obtained by dividing the theoretical size of a sieve that would pass 60 per cent of a sample by the effective size.

Both the 60 per cent and 10 per cent sizes are determined by plotting the results of sieve tests on logarithmic probability paper.

Sand Depth is a direct measurement in inches.

Sand Expansion is determined as follows: Distance in inches from top of sand to top of wash trough during washing subtracted from the normal free board times 100 divided by the normal depth of sand. For example, if the sand grains reach to within 12

inches of the top of the trough during washing and the freeboard is normally 24 inches for a 24 inch depth of sand, the expansion of the sand is 12 inches or 50 per cent. Sand expansion probably should be at least 40 per cent.

Rate of Filtration, expressed in gallons per square foot per minute, is determined with the influent valve to the filter closed. Observe the drop of water lost in the filter in inches per minute, and compute as follows—

$$\frac{\text{Drop in inches per min.} \times 144}{231}$$

In other words the vertical inches filtered in one minute when multiplied by 144 gives cubic inches drop per minute for each sq. ft. of filter bed surface. Dividing this by 231 cu. in. in one gal. gives gallons per sq. ft. per minute.

(The average in our plant before changing the sand was 2.3 gals./sq. ft./min.)

Wash Rate, expressed also in gallons per sq. ft. per minute, is computed just as was the Rate of Filtration except that after the washing is in full progress the waste or sewer valve is closed and the rise in inches per minute is determined. Compute as follows—

$$\frac{\text{Rise in inches per min.} \times 144}{231}$$

For determining the average Rate of Filtration in gals. per sq. ft. per minute for the entire plant compute as follows. The total gallons filtered during any period of hours is divided by the product of the total sq. ft. of filter area in use and the hours in operation times 60.

Likewise for the average Wash Rate in gals. per sq. ft. per minute for the entire plant compute as follows. Divide the total gallons of wash water used during a given period by the product of the total sq. ft. of filter area washed (number of filters washed $\times$ area of each) and total minutes of washing during the same period.

Method of Applying Sulphur Dioxide

1. Filter was thoroughly washed to reduce gas consumption by loose material.

2. Water was drawn down through sand and gravel well into manifold.

3. Main effluent header and wash water valve closed.

4. All small pipe connections closed.

5. A cylinder of liquid SO_2 (similar to chlorine cylinders) is attached to the effluent header by a brass pipe or heavy rubber hose with brass connections and standard chlorine fittings, then the SO_2 is added. The cylinder is inverted so that the liquid can be drawn off in short order (about 10 minutes). Various means can be used for inverting the cylinder; however, we used a method which proved satisfactory and can be seen in the picture attached.

6. As the liquid SO_2 is applied the washwater valve is opened a little, allowing water to enter, which forces the sulphur dioxide into the underdrain and up through the gravel and sand while the water rises to a three inch depth above the sand bed surface.

7. An acid resisting pump of 10 to 25 gpm. capacity is similarly attached to the effluent header and the sulphurous acid solution is circulated for a period of 24 to 48 hours or longer if necessary. After this the filter is given at least three back washings of five minutes each. This usually leaves the sand free of acid, which can be checked with a little Universal Indicator or some other acid-alkali indicator that is probably at hand. (N.B.—Some indicators are destroyed by sulfurous acid and cannot therefore be used.)

SO_2 Required

Sulphur dioxide required for treating a filter with a 2 per cent solution was as follows:

16.25 ft. x 22.2 ft. x 4 ft. bed	= 360 sq. ft. or 1440 cu. ft.
1440 cu. ft. x 62.5 x 40% void	= 36,000 lbs. water
To produce 2% solution	= 720 lbs. SO_2
3 inches water above sand	= 0.25 ft. x 360 x 62.5 = 5630 lbs.
To produce 2% SO_2, 3 inches deep over filter	= 112.1 lbs.
Pipes	= 30.0 lbs.
SO_2 for 2% solution	= 862 lbs.
Allowing 14% loss in various ways	= 122 lbs.
Total SO_2	= 984 lbs.
10 cents per pound	= $94.80 per filter

For the entire plant (8 one million gallon filters) 50.4 cylinders of SO_2 were required or 6.3 cylinders per filter. That is 7550 pounds of SO_2 for the treatment at a total of $755.

A Demonstration of the SO_2 Method of Cleaning Filter Sand in Place in the Filters *(Note the cylinder in inverted position for feeding the SO_2 in liquid form into the filter manifold while filling the filter slowly with water. The observers in the picture are named in the accompanying list.)*

This does not include labor used in this work.

Demonstration Arranged

Finally, the filters were all treated, sand tested and all filter rates and back wash rates adjusted. The final results were even better than anticipated. Since we were of the opinion that others in this section might be interested in this work, we invited members of the State Board of Health along with water works officials from several other towns and cities to visit us and witness a cleaning demonstration. The following men came on the appointed day:

Mr. N. M. DeJarnette, Georgia State Board of Health.

Mr. W. L. Averett, Georgia State Board of Health.

Mr. John J. Quinn, Knoxville Water Department.

Mr. N. F. Neff, Knoxville Water Department.

Mr. H. B. Channon, Virginia Smelting Company.

Mr. L. G. Cannon, Berry Schools.

Mr. C. R. Johnson, Atlanta, Ga.

Mr. Sherman Russell, Atlanta, Ga.

Mr. H. W. Wells, Atlanta, Ga.

Mr. T. G. Harris, Atlanta, Ga.

Copies of our method of application were given to each of those interested.

Conclusions

1. Liquid SO_2 is easily obtained in convenient portable cylinders at reasonable cost. Usually the commercial grade can be purchased at 9 to 12 cents per pound.

2. The application is simple. The cylinder inverted may be connected to brass pipe by means of standard flexible tubing and the adaptors used with chlorine cylinders. Reinforced rubber tubing with brass unions may be used. The average cylinder can be emptied in about 10 minutes.

3. Labor costs are small, requiring only a few man hours to wash the filters preparatory to and after treatment and to connect the piping. The latter is a one man job.

4. The SO_2 reacts not only with manganese oxide but also with the iron oxide, etc. The sulphurous acid kills bacteria, plankton, disintegrates mud balls and opens closed parts in the collector (under drain) pipes; it reaches into inaccessible parts of the filter.

5. SO_2 is less dangerous to handle than many other aggressive chemicals that might be used.

6. Replacing the old sand with new is unnecessary.

Final Results

Average effective size of clear sand, 0.43.

Average uniformity coefficient of clear sand, 1.46.

Filter rate, 2.0 gallons per square ft. per min.

Average sand expansion, 30 per cent.

Average backwash rate, 31 gallons per sq. ft. per min.

Average sand depth, 30 inches.

Cost of treatment per 1 mg. filter, including labor and equipment, $97.20.

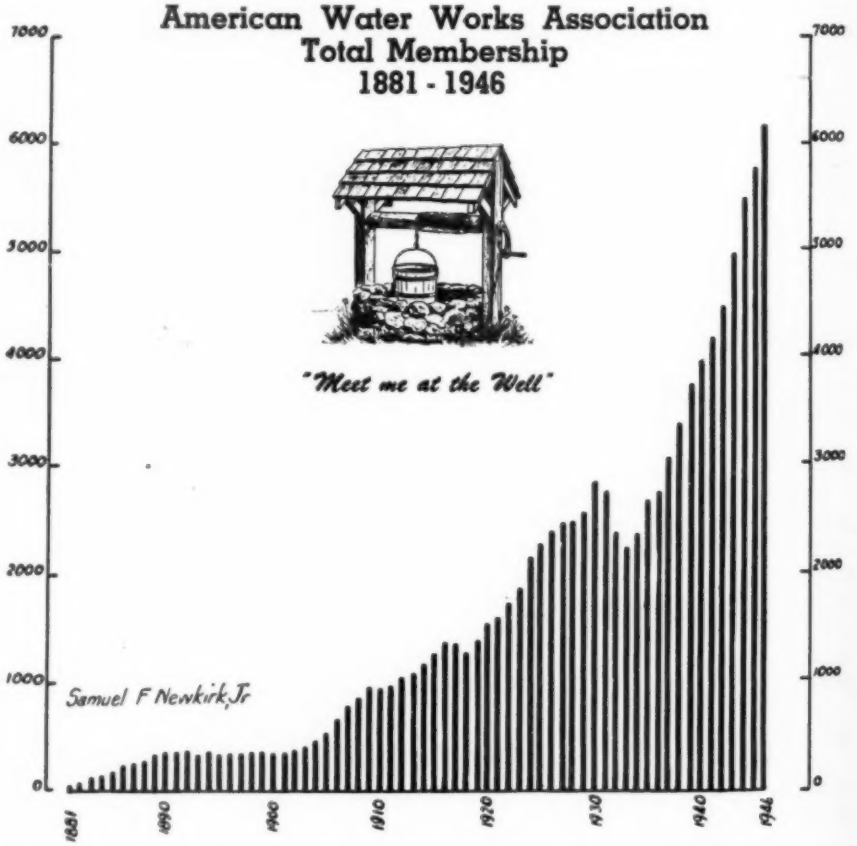
General filter conditions, etc., were greatly improved by the sulphur dioxide treatment, therefore we feel that the time and money were well spent.

The sulphur dioxide for this work was obtained in the liquid form from Virginia Smelting Co., Norfolk, Va.

Quite a Picture!

At the January meeting of the A. W. W. A. Board the Directors were handed the accompanying picture of the growth of the Association which had been developed by "Sam" Newkirk, Jr. (Sam II), past president of A. W. W. A.

One member examining this chart directed attention to the spectacularly steep climb in membership since the reorganization of A. W. W. A. some 10 years ago. At that time with a membership at the beginning of 1936 of 2682 members, a goal of 4000 members was set. It will be noted that this figure was reached just 5 years later under the dynamic secretaryship of Harry Jordan. Now in 5 more years the decade ends with a membership of better than 6000—a net *gain* of members almost equalling the 4000 *total* member goal set in 1936. To be exact, the total member gain during the decade 1936-1946 has been 3417. If any other technical association has equalled this record, we have not heard of it. There must be a reason!



We have taken the liberty of adding the *"Meet Me at the Well"* sketch to Sam II's graph. Readers will henceforth see more of this little sketch representing the "Old Oaken Bucket" hanging at the well. The "Old Oaken Bucket" is, as A. W. W. A. members already know, the official A. W. W. A. "cup" which the Californians take back home year after year as a symbol denoting that the California Section has what it takes to remain out in front as the largest Section in A. W. W. A. California's "Old Oaken Bucket" is fittingly to become the motif of the "theme" of the 1947 Convention of A. W. W. A. The bucket and reproduction of the old farm well from which it was taken is to become a center-piece of the convention; therefore we say to one and all, *"Let's Meet at the Well"* in San Francisco, July 21st-25th.

Detroit to Spend Ten Million on Sewerage

The Planning Commission of Detroit has set up a public works improvement program which is to involve an expenditure of $15,000,000 annually for the next six years. In 1947, $10,000,000 or more will be spent for new sewers and improvements to existing sewers.

OFFICE OPERATION IN A SMALL WATER COMPANY*

By C. M. HARTMAN,
Division Manager
WATER UTILITIES SERVICE CORP.
LEMOYNE, PA.

WHAT is a small Water Company? According to the Pennsylvania Public Utility Commission, water companies are classified as follows, based on the annual gross revenues:

Class D—$5,000 or less
Class C—Over $5,000 but not in excess of $50,000
Class B—Over $50,000 but not in excess of $250,000
Class A—Over $250,000

How many of the water companies that belong to the Pennsylvania Water Works Association are considered small, and are they operated as an individual company or are they associated with holding companies and operated under joint control? The following has been tabulated from the records of the Pennsylvania Water Works Association:

Annual Gross Revenue	Operation Individual	Joint
$ 5,000 or less	6	1
5,000 to $ 25,000	33	18
25,000 to 50,000	12	10
50,000 to 100,000	10	11
100,000 to 150,000	2	8

In the preparation of this paper, consideration will be given to the different methods of operation, i.e., as an individual company and under joint control.

Type of Operation

Individual Operation: Under individual operation the manager is, in most cases, solely responsible for the operation of the company and does not have engineers, accountants, legal advisers, etc., to fall back on in times of trouble, as in joint operation. The records that are maintained for individual operation generally are less than for joint operation due to the fact that the requirements are for the individual company and not for other offices. Under joint operations the records required would be prepared in duplicate, triplicate and in some cases six copies.

Joint Operation: When companies are consolidated under joint control the office requirements are usually far in excess of individual operation, as the operations, accounting, and statistics required are based on Class "A" operations, in order to have reports uniform. This should not be discouraging to the local office manager or clerks as they have a well trained staff to assist them with their problems. Also, they have a chance for advancement when vacancies occur in the larger companies in the group.

The Author

Office Personnel in Small Plants

The Manager: No office can operate to its best advantage unless there is complete cooperation between the manager, clerk, foreman, meter reader, etc. The manager must acquaint himself with the office procedure and its requirements; also strive to have complete harmony in his organization. It is especially stressed that the manager make a study of the office procedure for the reason that too often when clerks are absent due to illness or for some other cause, the manager is lost in his own office, not knowing where to go to locate an account, correspondence, forms, the balancing of cash drawer, preparation of routine reports, etc. It is not intended that the manager devote considerable time in the office, but when time permits, an analysis of office procedure could be made.

Class D Companies: There would be no office staff for companies in this class as revenues would not permit such an expenditure. Likewise the annual report required by the Pennsylvania Public Utility Commission consists only of a 5x8 in. card.

Annual Gross $5,000 *to* $25,000: It is doubtful if companies in this class would have an office or even a part time office clerk as the community served would undoubtedly be a small town where everyone knows where "The Man" (the water company representative) is and can locate him without undue hardship. Also the collection of accounts could be confined to a week every three months which would require the manager to remain at the headquarters of the company, wherever it may be. An alternative would be to have bills payable at a local bank.

Gross Revenue $25,000 *to* $100,000: Companies with gross in excess of $25,000 will require an office clerk. For the smaller companies in this group, say up to $50,000, it may be advantageous and economical to have a part time clerk rather than full time, such as 1 p. m. to 5 p. m. daily, or staggered days as Monday, Wednesday and Friday. The office hours should be entered on all water bills and posted on the door.

Companies with gross from $50,000 to $100,000 should have a full time clerk.

Customers' Accounts

Posting of cash and billing constitute the major portion of a clerk's time. The billing can be done in different stages and by different methods, depending upon the number of metered or flat rate accounts. If the utility desires an even income of cash, the quarterly accounts could be subdivided by zoning the territory served into three parts so that about one-third of the accounts would be billed monthly. For the smaller companies this is not recommended, as billing of all accounts every three months is not a burden and confines the interruption in office procedure to a short period when customers come in to pay their accounts.

If the territory is zoned, it could be divided so as to bill one-half of the quarterly accounts each month, which leaves one month without billing; or divided into three zones, billing one-third of the accounts each month. The number of sheets in a meter book should not be in excess of what a meter reader can read in one day. This will vary according to the territory—dense or sparsely settled.

The accounts should be divided into routes so that each route would contain only the accounts for each two meter books; for flat rate accounts not over 300 accounts for each route. A control should be established for

*This paper presented before the Pennsylvania Water Works Association is here published by permission of the Association.

each route, with a summary control for all routes. With this method when balancing, errors can be confined to approximately 300 accounts rather than having one control for all accounts and having to go through all the accounts when errors exist. Above all, accuracy is important—speed does not count when time is lost trying to locate mistakes.

The meter book should be ready approximately four days before the clerk is ready to bill and, if time permits, the clerk can bill two books in one day, against reading time of one day. The meter reader should compute the consumption at time of reading the meter and if any unusual consumption is noted he should endeavor to locate the cause and make a notation of his findings in the meter book, but he should at no time advise the consumers the amount of their bills when reading meters. This can be courteously handled by stating that the billing is done in the office.

As accounts must be balanced and various reports prepared each month, billing should not be started until the 10th or 15th of the month, depending upon the time required to prepare bills. The clerk should verify the accuracy of the consumption entered before preparing bills.

All allowances to customers should be approved by the manager. The manager should note especially the number of allowances made for errors in computing consumption, amount of billing and meter reading. The reason for this suggestion is that he will know whether or not the clerk and meter reader are performing their duties properly. Too many errors are a signal that inefficiency has developed in the organization.

When notices are mailed for delinquent accounts, no more notices should be mailed than can be handled by the collector in one day. If notice is given that water will be shut off on a certain date, if the account is not paid, then the notice should be followed through; otherwise, you will have the same thing when the next bills go out. Consumers can be educated to pay their accounts when due if proper methods are used to enforce collections. Once they are trained and realize you mean business, the manager's headaches will cease and he, the clerks, and collector will have more time to devote to other business.

Records

Payrolls: Time slips should contain, in addition to the employee's name and other information required by the company, a brief description of the nature of work performed, such as "New Service 207 Oak," "Raise curb box 1519 Ridge," etc., should be given, not the title of the account to be charged, such as "Maintenance of Services," "New Services," etc. If daily time sheets are used they should be given to the clerk daily; if weekly time sheets, then promptly each week. The clerk should assign the account number to be charged in order to get used to the proper distribution. In case of the manager's absence this work could be handled by the clerk. The manager should review each time slip as to its accuracy and then give the slips to the clerk. If daily slips are used, these should be given to the clerk at least every three days for entry upon the payroll, thus eliminating an accumulation of work.

Materials and Supplies: The stock issued, or reclaimed slips, should be given to the manager daily for his approval and assignment of account number. The reason for suggesting that the manager verify the stock slips is that in most cases he will be in a position to know whether or not the material listed thereon is correct. For example, there may have been a valve charged to a job and no roadway box or some other inconsistency. The posting of stock records should be done by the manager or someone thoroughly familiar with the material and use thereof, as there are so many different names used for material other than that shown on the stock records or invoices that this usually creates considerable confusion to a clerk when working on stock ledgers. If the manager or other informed person posts the stock records they can readily see whether items often used are running low or material was used which was not in stock. The clerk can balance the stock ledger. Schooling of the clerk by the manager should be done at intervals so as to familiarize the clerk with this work.

Complaints, etc.: A form should be provided and readily accessible to the clerk for recording all complaints received over the counter or by telephone. The form should be so arranged as to give the customer's name, address, complaint, procedure of the company in regard thereto, the initials and report of the employee making the investigation and, when required, the approval of the manager. These should be filed for reference in future complaints.

Office Organization in Large Plants

Companies in the class of Gross Revenues $100,000 to $150,000 will require two clerks. The office procedure should be so divided that both clerks will have certain duties to perform. In order that both clerks become accustomed to all requirements, the schedule should alternate duties every third or fourth month.

The clerk at the counter, let us say the cashier, will be interrupted continually and should be assigned work that is of reasonably short duration. A suggestion as to other assignments would be typing forms, service records, meter records, complaint orders, petty cash, stock records, and so on. The cashier should prepare cash reports, deposit slips, arrange cashier coupons in order for posting to accounts receivable before coupons go to the other clerk for posting.

The second clerk should be responsible for maintaining the accounts receivable, which include billing, posting of cash and other credits, balancing delinquent notices, preparation of billing reports; also balance security deposits, record interest due on deposits which are to be credited to the customers' accounts, prepare payrolls, general stenographic work and filing.

Where there are two or more clerks, each should have a separate cash drawer for which they are responsible. When the cashier is out of the office, the other clerk could handle cash, but out of the drawer assigned to her only. The clerk could make settlement to the cashier once a day.

Office hours should be arranged to meet the convenience of the community. For example, if requirements were from 8:00 a. m. until 5:00 p. m., one clerk could work 8:00 to 11:30 and 12:30 to 4:30 p. m.; the other 8:30 to 12:30 and 1:30 to 5:00 p. m. If the hours were to include Saturday, 8:00 to 12:00 noon, the latter clerk's hours could be 9:00 to 12:30 and 1:30 to 5:00 and on Saturday, 8:00 to 12:00 noon. On Saturday there would be only one clerk on duty, alternating the clerks' hours every week or every two weeks.

The manager should endeavor to give dictation not more than twice daily, as continual interruptions will cause inefficiency. After the mail is received in the morning and before dictating, he should collect the required data, study his subjects, then call the clerk for dictation. The same should apply for the afternoon mail. Compiling statistics for water pumped, chemicals used, unaccounted for water reports, etc., should be done by the manager or under his direct supervision.

OPERATION OF WELL SUPPLIES

By R. W. SIMPSON
Sanitary Engineer
GILBERT ASSOCIATES, INC.

THE two main sources of water for domestic and industrial use are surface and ground water supplies. A municipality or industry located near a large surface supply can process the water to a degree acceptable for use. In this case, the most important problem is not available supply, but efficient treatment.

Where surface water supplies are not available, or the available supplies are badly contaminated, municipalities, as well as industries have found it necessary to utilize ground water. Although there are definite advantages to ground water supplies, such as low temperature, constant mineral content, low bacterial content and others, the available volume may decrease. Too often, the attitude is—pump as much water from the ground as possible, with little thought given to the possibility of depletion of the supply. Industries and municipalities have both considered it their inalienable right to withdraw as much water from the ground as possible. With the increase in the use of air conditioning, the drain on the stored ground water supply will become greater and greater.

Is it logical to endanger our ground water resources? If the problem is studied thoroughly, the conclusion will be reached that conservation must be exercised in the operation of well supplies, for the benefit of the individual concerned, as well as the area as a whole.

More importance is placed on this problem, when it is realized that a large per cent of all municipal water obtained in this country is from well supplies. The U. S. Geological Survey has been conducting studies and collecting operating records for years, to chart the available ground water and predict safe limits of withdrawal. Co-operation with these efforts is essential to any program of conservation.

What safeguards can the municipal operator, or industrial water supply operator, take to assure an adequate supply and guard against over-working of wells? Certain operating procedures should be followed wherever well supplies are a source of water.

The Author

Operating Records

It is essential that accurate operating records be maintained. These records should include the total volume of water pumped daily; the hours of operation; the rate of pumping; the identifying number of the well in use; (where more than one well is used) weekly static level measurements; weekly draw-down measurements; and monthly chloride determinations. Notes as to sand pumped etc. are also useful.

Of these records, probably the most important are the static level and draw-down measurements. The results of these measurements indicate the availability of the ground water supply.

Many operators are not familiar with methods of determining these important factors, although several alternative methods are available.

Static Level Measurements

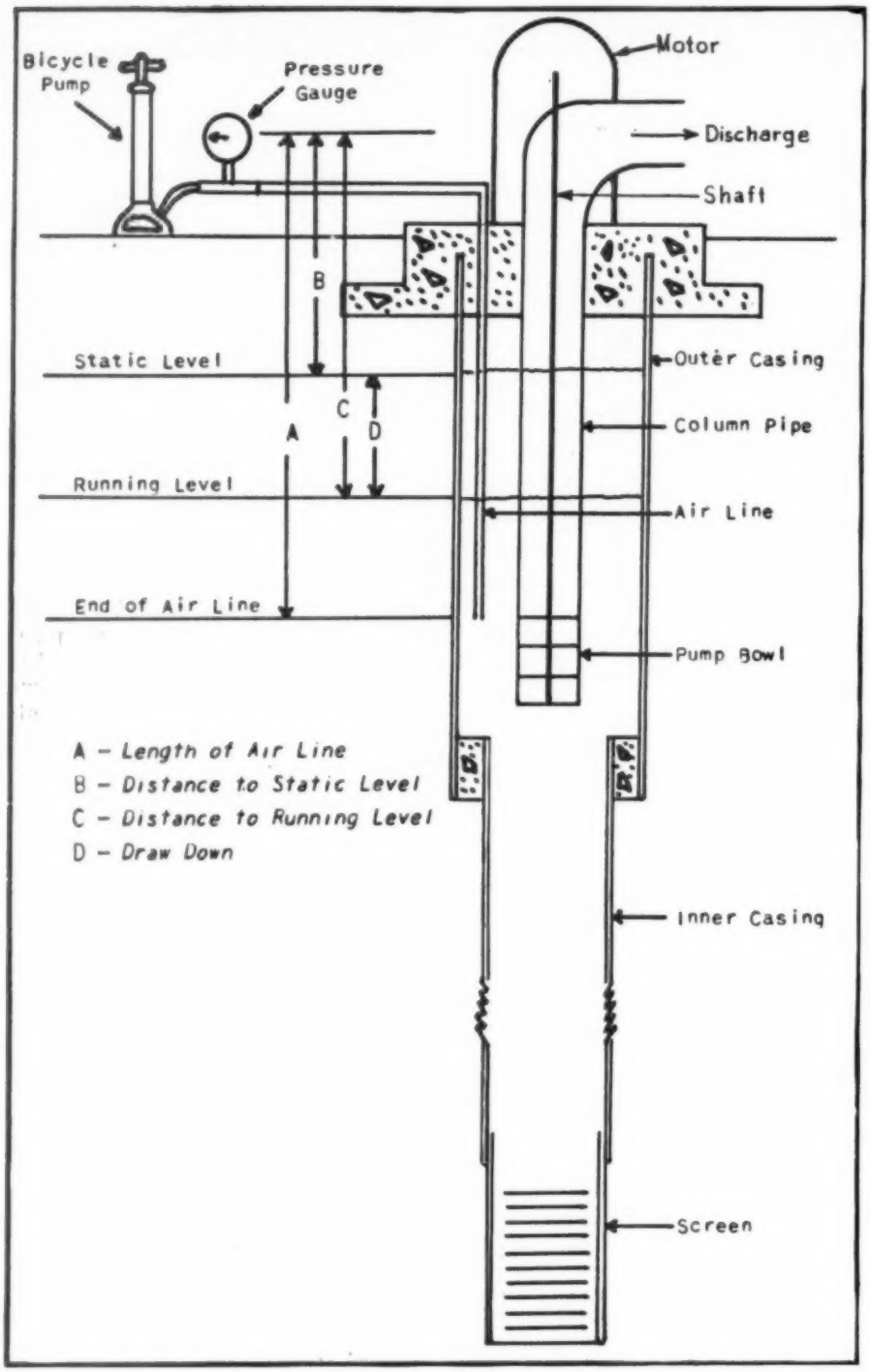
By definition, the static level is the height or level of the water in the well, when the well is not being pumped. If this level is above the strata from which the water is obtained, that is, if there is a head on the strata which forces the water up in the casing of the well, the well is considered an artesian well. Contrary to popular opinion, an artesian well does not have to flow at the surface of the ground.

There are three established methods of determining the elevation of the water in the well. The simplest method, applicable to wells less than 100 feet deep or with the water level less than 100 feet from the surface, is to measure the depth with a steel tape. Chalk is rubbed on the face of the tape and the tape, with a small weight, is lowered a measured depth into the well. The tape is withdrawn, and the chalked end examined for a water line. The length of the water line is subtracted from the measured length of tape inserted, showing the actual depth to the water line. The static level has been obtained.

For deep wells, where it is not feasible to use a tape, an air line can be used. In this case, an air line must be installed in the well between the well casing and the column pipe. Specifications should require that this air line be installed at the time of pump installation. When an air line is used for determining the static level, the length of the air line must be known. An air valve and gauge is placed at the top of the air line, and a pump—a simple bicycle pump may be used—is attached. By building up a pressure in the air line, the static level is determined as follows: the pump is operated until the pressure indicated on the gauge becomes constant. Since this pressure then represents the depth of water between the static level and the end of the air line, it is subtracted from the length of air line, resulting in the actual static level. If the gauge reads in feet, this is simple. If the gauge reads in pounds, the pressure in pounds is multiplied by 2.31 to convert to feet of head.

A third method employs electrical conductivity. A slight charge is placed on the casing which extends below the water level. A wire connected to a receiver is then lowered slowly until an audible buzz is detected. It is then known that the wire lowered into the well is at the water surface and completing the circuit. Measurement of the length of wire used gives the static level.

Since the methods used in determining the static level are simple, what is its significance? First of all, it is a measure of the pressure on the aquifer tapped by the well. The determination should be made weekly and results kept in tabular form. There will be some variation from week to week, but the variation should not exceed 10 per cent of the mean. If the static level begins to lower, and this recession continues,



Diagrammatic Sketch of Typical Well
Bicycle pump and pressure gage for determining levels, shown at left.

it is a forewarning of trouble. Recession of the static level indicates that the stored supply in the aquifer is being depleted by overworking the well itself, or interference of neighboring wells. Well production then must be curtailed, or the drop will continue until the supply is exhausted or the pump is out of water.

Draw-Down Measurement

The determination of the draw-down is as important to proper operation as are static level readings. By definition, the draw-down is the difference in water level in a well due to the operation of the pump. Simply, draw-down is the difference between the running level and the static level.

Since the method of determining the static level has been discussed, it is quite simple to obtain the draw-down. In determining the static level, the water level is measured while the pump is not operating. In determining the draw-down, the elevation of water is measured while the pump is running. The measurement is known as the running level. Draw-down is the difference between the running level and the static level. The draw-down is the true measure of a well.

When a well capacity is specified in a drilling contract, the allowable draw-down should be specified also. Specific capacity is the yield in gpm. per foot of draw-down and is a true measure of well capacity. Adequate records of draw-down measurements are necessary. When the static level measurement is made each week, the draw-down should be measured and recorded also. A diagrammatic sketch of a typical well is shown in the accompanying drawing.

The significance of draw-down variations is more important than static level measurements. As long as the draw-down remains relatively constant, it can be assumed that the aquifer is not being depleted and the well itself is in good condition. As the draw-down increases, the running level of the well is retarding. As in the case of lowering of the static level, the aquifer may be overworked, or due to low rainfall at the regeneration area, the stored supply may be depleted.

Increased draw-down may indicate mechanical defects also. A leaking casing or column pipe may be the cause. If the casing is leaking, no remedial measures are available. The only alternative is to recase the entire well. The column pipe can be removed and reset, plugging all leaks, or replacing bad lengths. Clogging of the screen, gravel packing, or the stratum itself may be the cause of the increased draw-down. When sand particles clog up the screen and spaces in the gravel packing, the rate of infiltration into the well itself is retarded. The pressure on the aquifer may be the same, but due to additional friction, the pressure in the well is less. Cave-in of water bearing stratum also results in an increased draw-down. Such a cave-in should not occur, however, unless the well has been producing large quantities of sand.

Since many variables would effect the results of static level and draw-down measurements, conditions for taking these readings should be standardized.

Before taking the static level measurement, all wells in the field should be shut down for at least two hours. Shut down of one well, but operation of others in the same field and in the same strata gives erroneous results.

Conversely, before the draw-down is determined, all wells in the field should be in operation for at least two hours to become stabilized.

Recovery Measurements

The importance of weekly static level and draw-down measurements has been stated. It is also advisable to determine the rate of recovery of a well at least twice each year.

After a well has been in operation for at least two hours, the running level is determined. The pump is then shut off, and the water level determined every five minutes until the level becomes stabilized. If the well is in good condition, the level should rise rapidly at first and then slowly level off. These results should be plotted and the curves filed.

Comparison of recovery tests will indicate the condition of the screen and gravel packing. If the well recovers completely, but the rate of recovery is much slower than the previous tests, the strainer or gravel packing may be clogged, thus increasing the friction in the aquifer.

Operating Procedures

It is apparent that the static level and draw-down measurements may be used as a "yardstick" for efficient well operation. There are well defined operating rules which if followed will minimize the chances of overworking a well supply. No control over nature is possible, however. Ground water supplies are dependent upon sufficient rainfall in the regeneration area to supply the water withdrawn from the strata influenced.

Where more than one well is drilled into the same strata in a particular well field, it is good practice to stagger operation—that is, operate the wells at different times. By so doing, interference of one well with another is reduced.

In most cases, wells are not operated continuously 24 hours a day, seven days a week. A rest period during times of low consumption is possible. Whenever a well can be rested for a full 24 hour period, rather than a few hours at a time, beneficial results are obtained.

To assure that a well is not overworked, the specific capacity (yield per foot of draw-down) should be determined when the well is being tested. When the pumping equipment is specified, the maximum pumping rate should be ½ of the specific capacity.

Maintenance and Repair

Since it is possible to diagnose causes of reduced well yields from the static level, draw-down measurements, and recovery tests, it is also possible to remedy some of the trouble experienced.

The first rule for the average well operator, when experiencing trouble, is to call a well expert to make the required repairs. Reworking wells and cleaning screens is not a simple job, and requires skilled technicians.

Screens may be cleaned in several ways. Acid washing, if the water produced has a high carbonate or iron content, is quite successful. Muriatic acid, to give a concentration of approximately 15 per cent at the screen, is introduced into the well through a special pipe lowered to the top level of the screen. The acid is allowed to remain in contact with the screen for about five hours. After the acid pipe is withdrawn, the pump is operated and the water wasted, until pH determinations indicate that all the acid is removed from the well.

Surging a well is a simple method, which can be utilized by many operators for cleaning a screen. The well discharge is disconnected from the system, and the pump alternately started and stopped. When the pump starts up, friction resulting from the water passing through the screen is reduced, and some sand is loosened up. When the pump is stopped, the water in the column pipe exerts a pressure on the sand grains clogging the screen and tends to wash them out. The alternate starting and stopping tends to loosen up considerable sand and clean up the screen.

Summary

1. Ground water, the only source of water in many areas, should be guarded against over development.
2. Regular measurement of the static level and draw-down and specific capacity of wells will indicate the condition of the well and the aquifer.
3. When trouble is experienced with well operation, it is economically sound to call in well experts to rework the well or clean the screen.

Hoff and Turner, Consulting Engineers, Austin, Tex.

Barnes Hoff and Marvin C. Turner have announced the formation of a partnership for the general practice

Marvin C. Turner

of engineering under the firm name of Hoff and Turner, Consulting Engineers, at Austin, Tex.

Mr. Hoff is a registered professional engineer, a member of the Texas Society of Professional Engineers, and an ex-student of Texas Technological College. He formerly worked for the Texas Highway Dept. for 15 years and was loaned by that department during the war to the U. S. Army Engineers, later being employed by Holland Page, contractors, before forming his own consulting engineering firm about two years ago.

Marvin C. Turner is well known to water works men of the Southwest, having served as chairman of the Southwest Section of AWWA during the past year, vice chair. the preceding year, and Trustee for Texas during 1941-42. In addition to these activities, he appeared on several programs of the Southwest Section as well as those of the Texas Water Works and Sewerage Short School, the Arkansas Water and Sewage Conference, and the Oklahoma Water and Sewage Conference. He has also been active in the Capitol Area Water and Sanitation group, having served as president of that organization. Mr. Turner is an ex-student of the Univ. of Texas and a registered professional engineer.

Practice of L. J. Voorhies Taken Over by Carnegie & Smith

The office, equipment and unfinished work of the late L. J. Voorhies, Consulting Engr. of Baton Rouge, La., has been taken over by Carnegie and Smith, Consulting Engineers, 3000 Dalrymple Drive, Baton Rouge, La. Members of the firm are S. Steve Carnegie and Fred E. Smith.

SELECTION OF WATER METERS FOR CUSTOMER SERVICE*

By S. F. NEWKIRK, JR.
Engr. & Supt.
WATER BOARD
ELIZABETH, N. J.

THERE are 28 different types of fluid meters, according to the A. S. M. E. classification, distributed under two divisions and eight classes, as shown in Table 1. In this discussion, however, only those types which are almost universally used in the water works profession for the measurement of supply to customers will be considered.

Basically, there are only two classes of meters used for general water customer service—the positive, volumetric type and the inferential, current (kinematic) type. Compound meters, both for general service and for fire service, are really combinations of these basic types.

Table 1

A.S.M.E. CLASSIFICATION OF FLUID METERS

Division	Class	Type
QUANTITY METERS		
1. Positive	1.1 Weighing	1.11 Weighers
		1.12 Tilting traps
	1.2 Volumetric	1.21 Tank
		1.22 Piston
		1.23 Disc
		1.24 Rotary
		1.25 Bellows
		1.26 Wet drum
2. Inferential	2.1 Current (kinematic)	2.11 Propeller
		2.12 Anemometer
		2.13 Turbine
		2.14 Helical
RATE OF FLOW METERS		
	2.2 Head (kinetic)	2.21 Venturi
		2.22 Flow nozzle
		2.23 Thin plate orifice
		2.24 Pitot
		2.25 Centrifugal
		2.26 Friction
	2.3 Area (geometric)	2.31 Gate
		2.32 Orifice & plug
		2.33 Cone & disc
		2.34 Cylinder & piston
	2.4 Head-area (weir)	2.41 Rectangular notch
		2.42 Triangular notch
		2.43 Special notch
	2.5 Force	2.51 Hydrometric pendulum
		2.52 Vane
	2.6 Thermal	2.61 Electric

Selecting Meter Types

Displacement meters, which are practically positive in action and carry over a fixed quantity of water for each cycle of operation, are by far the most used. Generally, this type should be used on all installations for which the maximum demand does not exceed 160 gpm.

*This paper, presented before the N. Y. Section of A.W.W.A., is here published by permission of the association.

The Author

The current meter, which registers flow by recording the revolutions of an impeller, set in motion by the force of the flowing water, has but little use in water distribution. Because of its low accuracy on small flows, its use is restricted to railroad standpipes, elevators, water carts, water motors, irrigation systems and other installations requiring free discharge and heavy service, with little probability of small rates of flow during day or night.

Compound meters combine a main meter of the current or displacement type, for measuring large flows, with a small, displacement type meter, for measuring small flows, in conjunction with an automatic valve mechanism. In the author's judgment, this is the correct instrument for measuring water when the demand varies between 160 gpm. and 1,000 gpm. For larger flows, a battery of compound meters should be used. Some operators favor a battery of displacement meters instead of a compound meter because of the low accuracy during the "change-over" from the by-pass to the main unit of the compound meter. The selection of the proper size compound meter to a degree eliminates this objection.

The fire service meter is a compound meter in which a proportional type main unit, for measuring large flows, combines with a small displacement type unit, for measuring small flows, in conjunction with an automatic valve mechanism. This combination is designed to afford an unobstructed passage through the main meter when its valve is raised from the seat. The measurement of flow recorded on the main unit, through which only a relatively small portion of the total flow actually passes, is likely to be inaccurate unless care is taken to keep all parts of the meter clean and in the very best working condition. The fire service meter should never be used for general service.

Selecting Meter Sizes

The selection of the correct type of meter is relatively easy, but the determination of the proper size is complicated and requires careful calculation, coupled with experience and practical knowledge. The size depends largely upon the expendable pressure available, and may be determined by learning the maximum demand and permissible pressure loss and by referring to a capacity curve of the meter to be used.

To estimate the maximum demand before service for many establishments, one can refer to any of the standard plumbers' manuals, in which the required capacity for various fixtures is given in gallons per minute and the probability of simultaneous operation is estimated. Table 2, taken from a handbook published by the Copper and Brass Research Assn., offers an example of such capacity estimations.

Table 2

RATES OF FLOW REQUIRED BY PLUMBING FIXTURES

Fixture	Flow*
Bath	8-10
Lavatory	5- 8
Tank closet	3- 5
Flush valve closet	30-40
Shower	5- 8
Sink	8-10
Laundry tub	8-10
Garden hose	5-10

*gpm.

The rate of flow may be approximated, as a rule, by dividing by four the amounts given in Table 2 for residences, apartments, schools, office buildings and other buildings in which the character of water consumption is similar. For clubs and hotels, the amounts should be divided by three; for gymnasiums, hospitals, public comfort stations and other such institutions, by two; and for public baths, laundries and factories, the full amount should be allowed. Often special indications will require that factors differing from those recommended be used. At best, all these factors are arbitrary.

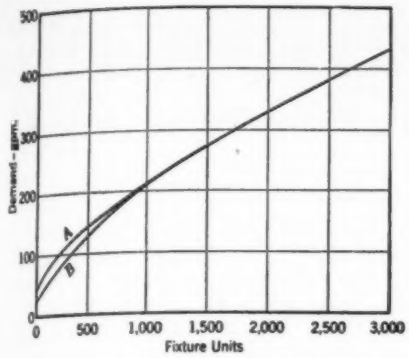


Fig. 1.—Graph for Estimation of Demands

(For enlarged section see Fig. 2)

As an alternative, the method of calculating the maximum demand outlined by the National Bureau of Standards may be used. The essentials of this outline consist of a table of demand weights for different plumbing fixtures and curves from which the estimated demand in gallons per minute corresponding to any total number of fixture units may be obtained. The demand weights, presented in terms of fixture units for different plumbing fixtures under different conditions of service, appear in Table 3.

One progressive water department[1] has developed a set of graphs (Figs. 1 and 2) for determining the proper size of service connections and meters. With the number and type of fixtures known, the probable maximum demand may be estimated. The total length of the service pipe may then be ascertained and the proper size of the service connection and meter determined from the graphs.

Any estimation of the demand of manufacturing establishments must include the quantity required by the manufacturing processes. This information can usually be obtained from the customer or the manufacturer of the equipment installed.

Table 4

RATED DELIVERY OF N. Y. CITY METERS*

Meter Size in.	Rated Delivery gpm.	Rated Delivery mil gal. per year
DISPLACEMENT METERS		
⅝	2.0	1.1
¾	3.4	1.8
1	5.3	2.8
1½	10.0	5.3
2	16.0	8.4
3	31.5	16.6
4	50.0	26.3
6	100.0	52.6
CURRENT METERS		
1½	10.0	5.3
2	17.5	9.2
3	40.0	21.0
4	70.0	36.8
6	160.0	84.1
8	280.0	147.2
10	437.5	230.0
12	640.0	336.4

*The load factor of compound meters is determined for each unit separately, and not for the meter as a whole.

Table 3

DEMAND WEIGHTS OF FIXTURES IN UNITS*

Fixture† or Group	Occupancy	Type of Control	Weight in Fixture Units‡
Water closet	Public	Flush valve	10
Water closet	Public	Flush tank	5
Pedestal urinal	Public	Flush valve	10
Stall or wall urinal	Public	Flush valve	5
Stall or wall urinal	Public	Flush tank	3
Lavatory	Public	Faucet	2
Bathtub	Public	Faucet	4
Shower head	Public	Mixing valve	4
Service sink	Office, etc.	Faucet	3
Kitchen sink	Hotel or restaurant	Faucet	3
Water closet	Private	Flush valve	6
Water closet	Private	Flush tank	3
Lavatory	Private	Faucet	1
Bathtub	Private	Faucet	2
Shower head	Private	Mixing valve	2
Bathroom group	Private	Flush valve for closet	8
Bathroom group	Private	Flush tank for closet	6
Separate shower	Private	Mixing valve	2
Kitchen sink	Private	Faucet	2
Laundry trays (1-3)	Private	Faucet	3
Combination fixture	Private	Faucet	3

*Supply outlets likely to impose continuous demands should be estimated separately and added to the total demand of the fixtures.

†Weights of fixtures not listed may be assumed by comparison with one using water in similar quantities and at similar rates.

‡For total demand. Weights of the maximum separate demands of fixtures with both hot and cold water supplies may be taken to be ¾ of the demand listed for the supply.

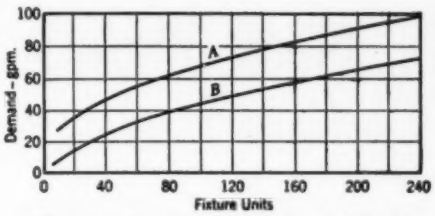


Fig. 2.—Section of Fig. 1 enlarged

Curve "A" applicable to systems in which flushometer valves predominate; curve "B" to systems in which flush tanks predominate.

Checking Meter Sizes

Whether a meter already in service is of the proper size may be ascertained by attaching a recording mechanism to the meter and obtaining data on the maximum and average rates of demand.

Table 5

RATED DELIVERY USED BY HAZEN FOR DISPLACEMENT METERS

Meter Size in.	Rated Delivery gpm.	Rated Delivery mil. gal. per year
DISPLACEMENT METERS		
⅝	7.11	3.74
¾	12.09	6.36
1	21.33	11.22
1½	42.67	22.44
2	71.70	37.40
3	142.20	74.81
4	213.30	112.21
6	426.70	224.42

Another very useful method for determining whether the meters in a water system are of the proper size is to establish a load factor for the meters and let the regular meter readings show whether a meter is under- or overworked. A load factor, based on the permissible loss of pressure through the meter, has to be established for each community and sometimes for separate districts within a community, if the pressure variations are large. The load factor is the ratio of the average delivery to the rated delivery. The rated delivery must not be confused with the manufacturer's rating or the safe operating capacity of the meters, as such quantities are based on too great a pressure loss (15-20 psi.).

New York City uses a rated delivery based on a 0.25 psi. loss, and if the load factor is below 30 per cent of the rated delivery shown in Table 4, the meter is considered too large; if above 50 per cent, too small. Allen Hazen[2] uses a rated delivery based on a 5 psi. loss and considers the meter to be underworked if the load factor is 2 per cent or less. Table 5 shows the rated delivery used for the calculation of the load factors.

References

[1]Smith, M. C.: "Standards for Water Service"— *W. W. & S.*, 21:191 (1944).
[2]Hazen, Allen: "Meter Rates for Water Works"—(1918), John Wiley & Sons, New York.

New Jersey Section Has Novel Program

Mid-winter Luncheon Hears How to Make a Speech on the Water Works Business

THE object of the program scheduled for the annual February meeting of the New Jersey Section, A. W. W. A. (New Brunswick, Feb. 19) was "to offer some practical suggestions to the members for preparing a talk about the water works business, to give some pointers on the presentation of such a talk, to provide a reference source to which a prospective speechmaker can turn, and finally to demonstrate that 'anyone' can make such a talk." Said the committee, "If we can, so can anyone else."

There must have been a goodly number of persons in New Jersey who wanted to know how to make a speech about the water works business, because instead of the expected 90, the attendance turned out to be more than 150. Without doubt, one of the reasons for this large turnout was the very clever pre-meeting announcement sent out from the secretary's office.

In the New Jersey section, a mythical Miss Ann E. Body is secretary to the section secretary, Cy Tygert. "Miz Body" reports to the section membership following each section meeting, and while her literary style would turn a grammar teacher's hair white, her talents for humor and reporting are effective. It was Ann E. Body who wrote the announcement, a handwritten letter, complete with misspelled words, and naive sentence structure. Printed by a duplicating process, on the Section's letterhead, that was one announcement that the reader wouldn't toss into the circular file before reading.

A Speech on the Water Works

The scheme of the program was to cast the audience in the role of members of the Summerfield Boosters Club, meeting for their weekly luncheon, with a customary after-lunch speaker. **Thomas W. Coleman,** Mgr., Commonwealth Water Co., Summit, acted as president of the Booster Club, called the meeting to order and led the singing of one verse of America and the Pledge to the Flag. These "duties" over, Mr. Coleman introduced the speaker of the day, none other than that peerless Water Commissioner of Summerfield, Throckmorton P. Gildersleeve, played on this occasion by **Martin J. Flentje,** Sanitary Engr., Amer. Water Works and Electric Co.

In the role of Gildersleeve, Flentje introduced the various members of his staff, each of whom was to present his own phase of the operation of the water works system. At the same time that these various phases were being presented, each speaker was demonstrating how it should be done before a luncheon group.

Chairman
Roswell M. Roper
Gen. Mgr.
East Orange

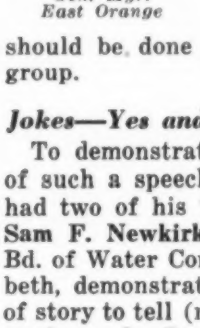
Secretary
C. B. Tygert
W & T
Newark

Jokes—Yes and No!

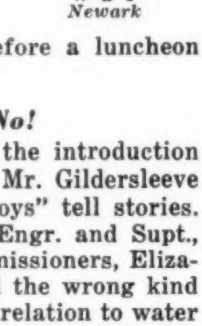
To demonstrate the introduction of such a speech, Mr. Gildersleeve had two of his "boys" tell stories. **Sam F. Newkirk,** Engr. and Supt., Bd. of Water Commissioners, Elizabeth, demonstrated the wrong kind of story to tell (no relation to water works and off-color), and **Charles H. Capen,** Chief Engineer, No. Jersey Water Supply Comm., Wanaque, gave an example of the right kind of story to tell, "*if* you *must* tell a joke."

History of Water Supply

The "speech" proper began with a brief review of the history of water supply. This particular topic was presented by **J. Arthur Carr,** Engr. and Supt., Dept. of Water Supply, Ridgewood, N. J. Mr. Carr traced some of the highlights of the development of water supply through the ages, and wisely avoided profuse chronological statistics. To indicate that the problems of today and their solution are not so different from those of more than a century ago, Mr. Carr referred to an act of Parliament establishing the East London Water Works in 1808, setting up rules, regulations, and restrictions in reference to the use and misuse of water, the location and depths of mains in streets, the opening of pavements, the right of entry on consumers' premises, and many other items that are for the most part identical with good practice of today. Mr. Carr also took his listeners back to the early days of New York City and told of conditions that led to the development of the Croton Reservoir Supply.



Commissioner
Martin J. Flentje
San Engr.
Am. Water Works & Electric Co.



and the Critic
G. E. (Doc) Symons
Assoc. Editor
Water & Sewage Works

Water Supply is Big Business

The water supply industry in any community is often the biggest business in town, according to **Arthur Bell,** Borough Engr., Essex Falls. Not only does the water supply industry handle a greater volume of product per day than almost any other industry; it is also absolutely essential to operation of all other industry as well as to community life. Being a business, the water works has to use business methods of operation. Records of operation of the various departments are essential to good management; and, in order to keep proper track of both the production and sale of its product, the water department employs meters to measure the flow of water at the plant and to measure the water used by the consumer. A few statistics and a lucid discussion of meters, their purpose and operation, are helpful in "selling" the water works to the audience.

Water Isn't H_2O

"It is a mistake to try to teach the chemistry of water to a luncheon club," said Peter Pallo, Asst. San. Engr., Hackensack Water Co., who showed, however, that a bit of information about water, what it is and how it acts, is helpful in getting the story across to men unfamiliar with technical terminology. While water is not a simple compound represented by the formula

H_2O, a complete recital of the 33 forms existing in water is not the way to explain why water expands when freezing, nor is the enumeration of detailed physical characteristics an explanation of why water sells for little more than five cents a ton. A judicious use of technical information, in not too technical language, will, however, be of considerable interest to a lay audience.

Chemical Magic

As a diversion from straight talking, the speaker may find the use of some chemical magic a relief device. Martin Flentje turned some water to wine, and back again, then in several other glasses (set up beforehand) made several colors appear and disappear as he poured water into them from a pitcher. Then Mr. Flentje explained what those colors mean to a water works chemist in the matter of control of water treatment.

Water Treatment

John L. Radcliffe, Chemist, Elizabethtown Water Co., asked the audience to imagine that it was a collection of bacteria in the raw water supply. Mr. Radcliffe then explained just what would happen to those bacteria during the process of water treatment.

Distribution

After the water is collected, treated and stored it must be distributed to the thousands of thirsty persons who want it. This delivering takes place in pipes known as the distribution system, which was explained by **Richard E. Bonyun,** Gen. Supt., Passaic Valley Water Comm. Mr. Bonyon also explained the reasons for high water bills and by means of an enlarged record of a Meter Master showed how in one home a leaky water toilet used more water than did the family itself.

Jokesters

Wrong Way
S. F. Newkirk
Engr. & Supt.
Elizabeth

Right Way
C. H. Capen, Jr.
Chief Engr., No. Jersey Water Dist.

And In Conclusion

Any speech on the local water works should lead to a logical and forceful conclusion, and one of the things that **Charles Bourgin,** Supt., Bur. of Water Supply, Montclair, stressed in his conclusion was the fact that the water is free to the consumer, and the charge is made for service in putting the water where the user can have it when he wants it.

The Audience Talks Back

Throughout this parcel presentation of "the speech," Martin Flentje, acting as Gildersleeve, the Water Commissioner, presented each of his "boys" to talk. At the conclusion of the talk proper, Mr. Flentje introduced **George E. "Doc" Symons,** Assoc. Ed. of *Water & Sewage Works,* whose billed function on the program was to criticize the presentation of "the Speech."

Pointing out that one of the first rules of good public relations is not to criticize individuals in the presence of groups, "Doc" chose to approach the task from the somewhat facetious aspect of the long suffering audience talking back to speakers in general.

With this approach and several anecdotes to illustrate the points, "critic Doc Symons" listed a number of do's and don'ts in the presentation of talks before luncheon clubs and pointed out differences between such a talk and a technical paper. These remarks were closed with a bit of doggerel titled "What th' Hell" to illustrate the pitfalls of a one-track vocabulary.

The N. J. Section plans to put the whole "speech" together and publish it as a reference piece. The "critics" remarks will not be included inasmuch as they are a part of a full length talk on the subject of the "Preparation and Presentation of Technical Papers."

"Commissioner Gildersleeve's Staff"

T. W. Coleman
Mgr., Commonwealth Water Co.
Summit
(Introduction)

J. A. Carr
Supt.
Dept. Water
Ridgewood
(History)

E. Art Bell
Boro Engr.
Essex Falls
(Business)

Peter F. Pallo
Asst. San. Engr.
Hackensack Water Co.
(Chemistry)

Richard Bonyun
Gen. Supt.
Passaic Valley Water Com.
(Distribution)

Chas. G. Bourgin
Supt.
Water Dept.
Montclair
(Conclusion)

(Each gave a part of a speech on the Water Works Business. Missing in above strip—Jack Radcliffe, who talked on Water Treatment.)

Life Insurance From the Buyer's Point of View

On page 92 of the March, 1945. issue of *Water Works and Sewerage* (now *Water & Sewage Works*) we ran a review of the book, "Life Insurance from the Buyer's Point of View." In that review we said, "There is probably no other place where, for the sum of one dollar, a buyer can obtain so much good information on life insurance."

In view of our comments in that review we were highly pleased to note recently that the Book-of-the-Month Club has recommended this volume to its members, and that Consumers' Research has likewise recommended it to subscribers.

This book may be obtained from the American Institute of Economic Research, Great Barrington, Mass.

"Not in the Water Business!"

The trouble with people who drink too much is that they don't drink what the fish do.

CIVIL SERVICE COMES TO ALEXANDRIA

By DONALD P. MORIARTY
Director of Personnel
CIVIL SERVICE COMMISSION
ALEXANDRIA, LA.

THE improvement of public service is one of the basic needs of the day and one of the most effective ways to improve the public service is for the governmental unit to operate under a civil service or merit system. Civil service is a timely subject because of the growing interest which the public is displaying in the quality of service it gets for its money. Experience gained in the war just ended has proved beyond a doubt the need for skill, experience, and efficiency in the administration of public affairs.

One-tenth of all adults in the United States who were gainfully employed before entry of the United States into the recent conflict were included on some governmental payroll and the total salaries exceeded 11 per cent of our entire national income. It may be presumed that these percentages are approximately true in the State of Louisiana. When so large a group of our people are to be found on public payrolls and so great a part of our national income is paid over to that group, surely our taxpayers, business men, citizens, and advocates of honesty and efficiency in government should feel that this is a vitally important matter which should receive their most thoughtful attention.

The need for competent employees was recognized by our national government just after its inception, but although many of our administrators exercised a high degree of care in choosing governmental officials and employees, no systematic method existed until 1883, when the Congress adopted the Pendleton Act and established a civil service merit system for most of the non-policy forming Federal employees. Since this law became effective, state-wide civil service merit systems have been established in 21 states, and in the remaining 27 states civil service regulations govern the employment of personnel in certain state agencies which are partly financed by federal funds. Since 1940 Louisiana has been among the 21 states which have a comprehensive merit system; and the cities of New Orleans, Alexandria, and Bogalusa are among the 1200 cities now operating under the merit system.

Desiring to better the public service to the citizens and realizing the advantages and security offered municipal employees by a Civil Service Law, the employees of the City of Alexandria banded together in 1940 to work toward the enactment in the State Legislature of a Civil Service Law to cover and protect them. Police and firemen were already covered under a state-wide Civil Service Law enacted in 1940, but other municipal employees not covered far outnumbered police and firemen in Alexandria.

First efforts were to have this new bill cover all the cities of 15,000 to 100,000 population and then the population limit was for the benefit of Bogalusa, La., lowered to include cities of 13,000. A bill of this type covering Louisiana cities in general was faced with difficulties in the Legislature, so the Alexandria group decided to introduce a new bill to cover Alexandria only.

Another bill to cover Bogalusa only was also introduced and both bills were passed without opposition. Assistance toward passage of these acts was given in the Legislature by the Louisiana State Federation of Labor and the Louisiana Civil Service League.

All of Alexandria's municipal employees are now under Civil Service with the exception of the elected officials and one private secretary to each official and one principal assistant to each official. The City Attorney and Assistant City Attorneys and special advisory boards, committees, etc., are likewise not under Civil Service.

The Alexandria Civil Service Law provides for a Civil Service Board of five members selected as follows:

One member is appointed by the Commission Council of the City of Alexandria; one by the Municipal Employees Association; one by the Executive Committee of the Alexandria Bar Association; one by the State Civil Service Commission. The four members thus appointed by a majority vote selects the fifth member. At the expiration of their respective staggered terms, all appointments henceforth will be for a term of four years.

The act further provides for a Director of Personnel, who is the chief executive officer of the commission and directs and supervises its administrative work. The first duty of the Director was that of making a survey of the employees of the city. From this survey positions in the city's services were classified, a pay plan adopted, and the building of suitable, practical examinations for the various positions was begun.

All employees holding their positions prior to January 1, 1944, were blanketed in by the law without examination, but it so happens that most of the top positions have become open since establishment of Civil Service in Alexandria, and examinations have been held for such important positions as: City Engineer, Superintendent of the Electric Department, Assistant Superintendent of the Electric Department, Superintendent of Water Works, City Tax and License Collector, Superintendent of Recreation. All of these positions have been filled through Civil Service by a high type, well trained person.*

At present work is being done towards the establishment of a "Service Rating Plan," giving due recognition to seniority, which when put into effect will provide an incentive and go a long way toward the improvement of the employees' attitude and performance. When this employee recognition and incentive plan is perfected, it is believed that municipal service to the citizens of Alexandria will benefit materially.

The elected officials, department heads, and employees of the City of Alexandria have been very co-operative in carrying out the new Civil Service Law and its rules and regulations, and in working with the Director of Personnel. It is through co-operation of this nature that improvement is being accomplished.

[*Ed. Note: Supt. of Water for Alexandria is S. L. Perry, Member of AWWA, who furnished us this article.]

TREATMENT AND CONTROL METHODS FOR INDUSTRIAL WASTES*

By L. F. OEMING
Sanitary Engineer
STREAM CONTROL COMMISSION
LANSING, MICH.

SOMEWHAT more than five years have elapsed since conditions arose compelling curtailment in construction of works for the control of stream pollution. During this period, tangible improvement in the form of waste treatment plants was provided to meet only the most critical problem. Eligibility for construction was determined upon a showing that a war-connected need existed. Although progress was retarded by this criterion, a number of installations were completed which have proven effective in solving individual industry problems. While these installations form the major accomplishments, progress has been recorded in other directions also. Research activity has continued, and studies have been carried forward, leading to developments which, combined with experience accumulated in the performance of existing facilities, furnish a firm foundation upon which to proceed in the future.

The examples outlined under the following industry headings represent developments and accomplishments which are of importance in connection with the industrial pollution control program in our state.

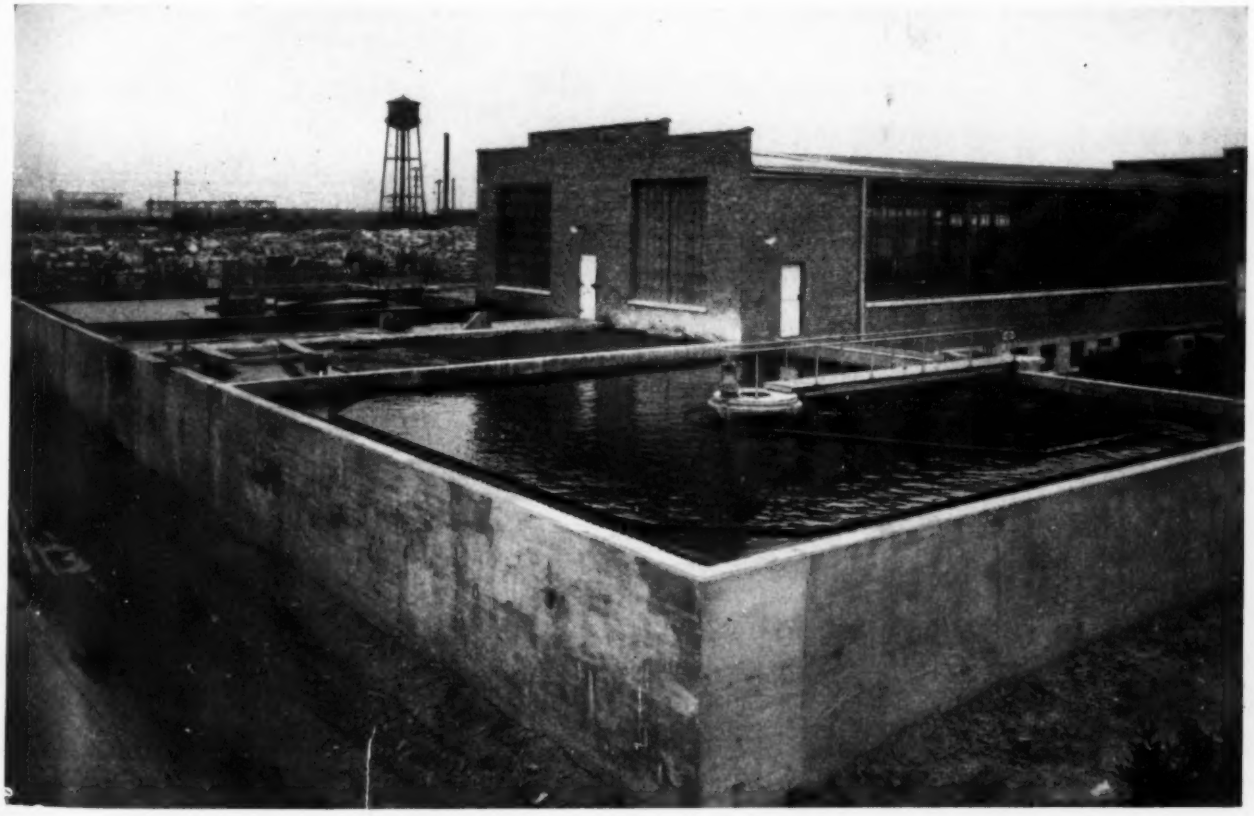
PAPER INDUSTRY

Improvement in the waste effluents from mills manufacturing paper board has been obtained by three methods.

Flotation

A high grade quality of effluent is being produced by flotation methods at the Sutherland Paper Co. in Kalamazoo. The mill uses prepared virgin pulp and has no cooking or pulping operations. Wastes consist almost entirely of water from the board machine. These are withdrawn from a receiving tank together with a small amount of air introduced by means of a pump and injector. After being placed under 40 pounds' pressure in a pressure tank, the tank contents are released to atmospheric pressure in an open, rectangular tank. Animal glue is added as a flocculating agent. Solids, largely fiber, rise to the surface and are skimmed by longitudinal collectors up an incline to a sump for incorporation into the paper stock. Clarified effluent is withdrawn from the bottom of the tank through a series of pipes spaced along the length of the tank. The major portion of the effluent is returned to the paper machine, thus reducing the mill water requirements and conserving dwindling ground water resources in the area. Waste volumes discharged to the river have been reduced from 2.1 to 1.3 million gallons per day. The retention period of the flotation tank is almost fifteen minutes when treating 900 gallons per minute of waste flow. It removes slightly over a ton of fiber per day that was formerly wasted to the stream. The following tabulation represents typical per-

*This paper presented before the Michigan Sewage Works Assn. is here published by permission of the Federation of Sewage Works Assns.



Paper Board Mill Waste Treatment Units—Monroe Paper Prod. Co., Monroe, Mich.

formance as found during a series of tests:

	Suspended Solids	Fiber	5-Day B.O.D.
Raw water	250	210	96
Effluent	28	25	48
% removal	89	88	50

Treatment by this method is obtained at a lower cost for structures than would be expended for conventional flocculation and settling units to accomplish the same result. Another unit has just been placed in operation in a mill using old paper and paper board as a raw material. Comparable results are being obtained when animal glue is supplemented with alum as a flocculating agent, indicating the possibility of extended application of the method for other board mills in the state.

Coagulation and Sedimentation

Settling and coagulation with alum has produced an effluent with suspended solids content and turbidity below that of the river at the Monroe Paper Products Co. mill. The mill produces paper and black panel board from waste paper and old cartons. It elected to sever its sewer from the municipal system, install separate treatment and discharge the effluent to the Raisin River. A standard of effluent quality designed to protect the individual riparian and public interest was imposed by the city upon the mill. It required that not more than seven pounds of suspended solids per ton of paper produced be discharged, and that color and turbidity be held to 100 ppm. or less. This standard represented a reduction in solids from 4000 to 700 pounds per day.

The treatment units consist of two flash mixers, two rectangular flocculators and two square sedimentation tanks with sludge collecting mechanisms.

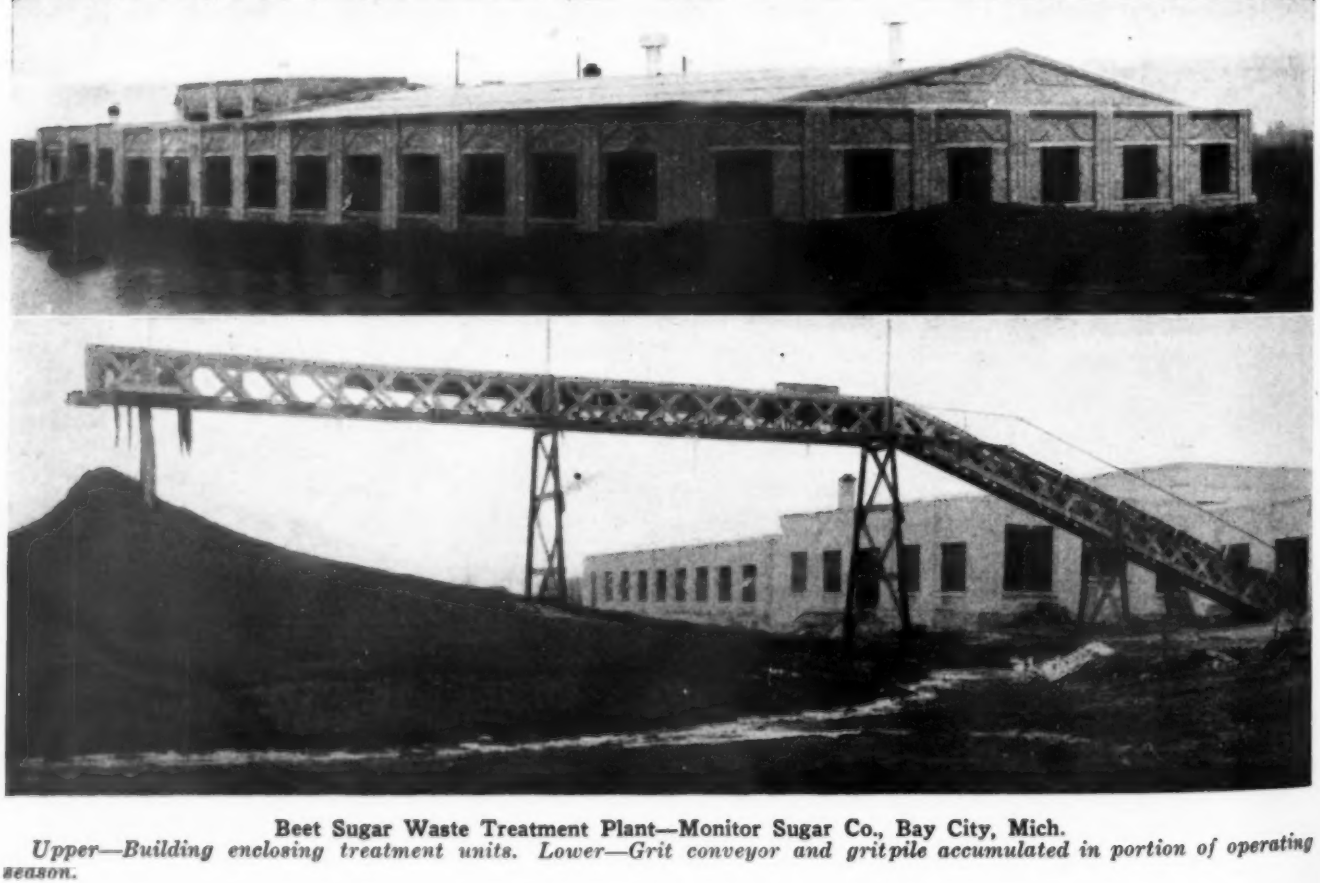
Waste flows amounting to 2.0 mgd. receive 50 minutes' flocculation and 4.5 hours' settling. Removals as high as 97 per cent in suspended solids and 47 per cent in B.O.D. have been obtained. Settled sludges are reclaimed for manufacture into panel board.

Sludge Blanket Filtration

Another board mill in the Monroe area, producing 1.0 mgd. waste flow, proposes to treat its discharges by installation of a process used in water softening practice. The principle involves upward flow of the waste through a sludge blanket which is permitted to accumulate at a predetermined thickness in the bottom of the tank. It operates on the theory that the settled solids act as flocculants and also have a filtering action on the incoming wastes. A circular tank is used with distribution of the raw wastes through a circular ring at the floor level. To prevent flotation and scum formation, air entrained in the wastes must first be removed in a form of head box. A flow equalizing device must be included to avoid lifting the sludge blanket by sudden changes of velocity within the clarifier. Provision for addition of a coagulant such as alum is included. Chlorination of the wastes is essential for the control of slime. The effluent requirements imposed upon the Monroe Paper Products mill apply equally to this installation.

Kalamazoo River Problem

Paper mill wastes from eight companies operating 18 mills in the Kalamazoo area impose an oxygen demand load upon the river equivalent to untreated sewage from a population of 158,000. Including the municipal sewage, the total oxygen demand at Kalamazoo is equivalent to raw sewage from a population of 218,000 persons. Entire valley mill discharges total 44 mgd. and carry 122 tons of solids and 15 tons of B.O.D. to the river daily. Under summer stream flow conditions, some twenty miles of stream are depleted of dissolved oxygen content. Oxygen sag curves developed from stream survey data disclose that a 40 per cent over-all re-



Beet Sugar Waste Treatment Plant—Monitor Sugar Co., Bay City, Mich.
Upper—Building enclosing treatment units. Lower—Grit conveyor and grit pile accumulated in portion of operating season.

duction of B.O.D. from all sources, both municipal and paper mill, will raise the minimum oxygen content to a value of slightly over 1.0 ppm., while a 65 per cent reduction and accompanying 90 per cent removal of suspended solids is necessary to prevent the dissolved oxygen content from dropping below 3.0 ppm. The latter value is considered as a reasonable objective in order to restore the stream to an acceptable condition.

In 1940 a research program was formulated by the valley mills and conducted by the Engineering Experiment Station of Michigan State College. An inventory of the waste sources was made, followed by pilot plant studies extending over a two-year period to determine the relative efficiencies of plain settling and chemical precipitation treatments. The data obtained indicates that the 65 per cent B.O.D. removal needed can be obtained by settling aided by coagulants, principally lime and alum.

Further studies are now in progress. The National Council for Stream Improvement of the Pulp, Paper and Paper Board Industry* organized for the purpose of conducting research covering all aspects of the waste problems in the industry has a project located at Kalamazoo for the study of de-inking wastes. These wastes total 11.5 mgd. and contain 70 tons of solids and 10 tons of 5-day B.O.D. They account for 26 per cent of the entire waste flow from all mills in the valley, but contribute 58 per cent of the solids and 70 per cent of the B.O.D. The research staff on this project is headed by a representative of the Mellon Institute of Industrial Research, with two representatives of the University of Michigan as consultants. Its findings and conclusions will be awaited with the utmost interest. The policy expressed by the Council in this activity gives encouragement that the stalemate in this problem can presently come to an end.

METAL INDUSTRY

Pollution control activity in the metal industry has centered largely upon oil, cyanide, and chromium bearing wastes.

Oil

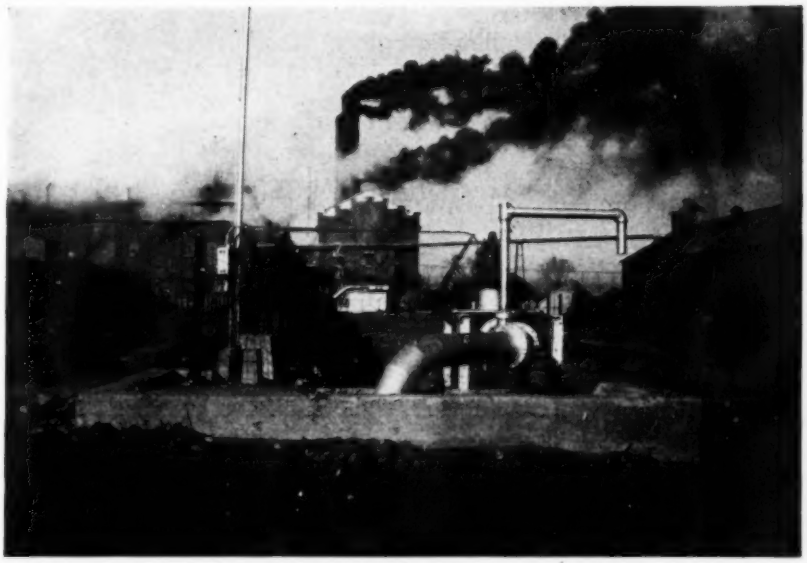
Acceptable limits of oil concentration in waste waters have not been generally established. In streams and lakes, oil becomes objectionable when it forms a film or "slick" upon the surface. In the majority of instances in Michigan waters, effluents containing not more than 15 ppm. are considered satisfactory. If the wastes enter a municipal sewage treatment plant, the limit may be increased somewhat, but it appears justifiable to maintain concentrations as near as possible to this figure for good plant operation.

A number of types of treatment devices have been proposed and are in use for removing oils. Installations vary widely in design and effectiveness. Separators embodying the features of design developed by the American Petroleum Institute for the refining industry have also proven effective in the automotive and forging industry. Adequate operation and maintenance is of prime importance in the performance of any of the separating devices.

Essentially, the recent designs provide for retention of the wastes for one hour in a rectangular concrete tank equipped with transverse baffle walls extending from near the floor level to above the liquid level. The oil trapped on the separator surface in the bays formed by the baffles is removed by skimming devices of various types. The most successful has been a horizontal pipe in which a slot has been cut, suspended at the liquid level so that it may be revolved about a horizontal axis to skim at the surface.

Two installations at the Willow Run plant of the Ford Motor Company used a proprietary device incorporating a departure from standard design. These installations operated successfully to prevent pollution during the war production period.

Oil waste treatment facilities have recently been completed at the Buick Motor Division in Flint. Four separator units were provided, one on each of four sewer outlets from the factory to the Flint River. Two of these follow the basis of design developed in the A. P. I. separator, one is a proprietary device of the same type as installed at Willow Run, and the fourth precedes the proprietary device with a gravity type separator. The relative efficiencies of the various types have not yet been determined. However, notable river improvement has been effected.



Lake Shore Sugar Co., St. Louis, Mich.

Center rear—Vibrating screen installation. Center front—Flume water recirculating pump. Middle—Flume and process water settling lagoon; cleaned by crane and clam shell bucket.

Cyanide

Removal of cyanide from concentrated solutions by decomposition with sulphuric acid has been practiced successfully for a number of years at the Chevrolet Motor Division in Flint. This method was also installed by the Ford Motor Company at its Willow Run plant.

The facilities consist of a tightly covered receiving tank, rubber lined or otherwise coated to prevent corrosion, and equipped with an air blower and vent stack. The solution to be treated is discharged to the tank, sulphuric acid is added and the contents agitated by blowing air through the solution. The cyanide is volatilized to hydrogen cyanide, which is blown to the atmosphere through the vent stack. With the addition of sufficient acid and an

*See article by Harry Gehm in the July, 1946, issue of *Water & Sewage Works*, p. 289, for the complete program of the National Council for Stream Improvement of The Pulp, Paper, and Paper Board Industry.

aeration time of about 16 hours, the cyanide is reduced to less than 1.0 ppm. and the treated solution can be discharged to the stream. The poisonous character of the evolved gases requires that the vent stack be high enough to avoid danger from these fumes.

The Chevrolet installation comprises a 5,000 gallon tank with a 60 ft. vent stack. In a typical treatment operation, 4,500 gallons of solution containing 2.8 ounces of copper cyanide and 1.1 ounce of free cyanide per gallon (i.e., more than 10,000 ppm.) were treated with 4,255 lbs. of 66° Baume sulphuric acid. The cyanide concentration was reduced to 0.98 ppm.

Isabella Sugar Co., Mt. Pleasant, Mich.

Sloping wall, cement lined, quick settler with Dorr irrigation type collector for protection of recirculating pump.

A method for converting cyanide to non-toxic cyanates is described in a patent (No. 2,194,438) assigned to the E. I. du Pont de Nemours Company. The reacting substance is calcium polysulphide which is available commercially as lime sulphur either in powder or solution form. Dosages required are 0.43 gallon of lime sulphur solution or 1.84 lbs. of solid lime sulphur per pound of sodium cyanide present. The reaction time is given as two hours at room temperature or one-half hour at boiling temperature. The hydrogen sulphide produced in the reaction should be removed from the treated effluent prior to discharge, either by aeration or by liberation with acid. Equipment is inexpensive and the process is simple to control. It is adaptable to the treatment of cyanide ash from carburizing processes as well as wash and rinse waters.

Experiments conducted by the Michigan Institute of Fisheries Research show that commercial sodium thiocyanate is 600 times less toxic than potassium cyanide. When treated wastes were used, discrepancies were found, indicating that cyanide removal is not complete. Reduction of the residual cyanide may be obtained by retaining the treated effluents in ponds for an extended period. The reaction is reversed with chlorine to produce toxic cyanogen chloride, thus requiring precaution be exercised where the effluents reach municipal sewage treatment plants employing chlorine for disinfection. The effects upon sewage treatment processes have been studied and found to be of minor consequence within the ranges which might reasonably be encountered.

Recent studies and developments in alkali chlorination have produced another method capable of reducing concentrations of cyanide to less than 1.0 ppm. It entails oxidation of the salt with chlorine to cyanate, carbon dioxide, ammonia, and sodium chloride. Various reagents have been proposed to obtain the desired reaction such as commercial bleaching powder, sodium hypochlorite, and liquid chlorine.

The widest range of adaptability is offered by the use of chlorine, either as liquid or gas, and caustic soda. The treatment requires that chlorination be performed under high alkaline conditions to avoid formation of cyanogen chloride and nitrogen tri-chloride. Maintenance of a pH of not less than 11.5 during treatment is recommended. Chlorine requirements range from 2 to 3 lb. per pound of sodium cyanide, depending on the nature of the reducing agents in the waste solutions. Copper is precipitated from electro-plating baths as the basic carbonate. Removal of zinc requires addition of carbon dioxide or sodium carbonate. Equipment needed will include a receiving or holding tank so proportioned as to furnish a 6 ft. depth of liquid, a platform scale to enable measurement of the chlorine used, and an arrangement for introducing chlorine into the liquid. The process is being studied for the effects which the end products might have on fish life and sewage treatment plant operation.

Chromium

At the Ford Motor Company's Willow Run plant, removal of chromium is accomplished by application of ferrous sulfate to reduce the hexavalent chromium to trivalent form. Neutralization with lime then precipitates chromium hydroxide as sludge which is placed in a lagoon.

BEET SUGAR INDUSTRY

For many years waste treatment practice for flume water, battery wash and pulp press water consisted of coarse screening followed by settling in large ponds. Lime cake slurry was settled in separate ponds to permit recovery of dried cake for agricultural purposes. Some reduction in solids was obtained by these methods, but the oxygen demand of the effluents generally equalled and often exceeded that of the unscreened wastes. Wastes from the Steffens process were retained in separate ponds throughout the operating period and released during high water in the spring. Studies seeking improved treatment methods were undertaken by the industry with the aid of the Engineering Experiment Station of Michigan State College. The results obtained were incorporated in a general order by the Stream Control Commission on September 1, 1937. Under the terms of the order, Steffens waste discharges were expressly prohibited and factory wastes, except Steffens, were restricted in polluting content prior to discharge to not more than 5 pounds of 5-day B.O.D. per ton of beets processed. The limitation placed upon factory wastes represents a substantial reduction in former oxygen demand values which had been found to average 12.2 pounds per ton of beets processed.

Compliance with the order has been provided by a variety of meth-

ods. The installation at one company follows closely the recommendations and conclusions drawn from the experimental program. The remaining companies have adopted methods combining treatment and control which depart considerably from the basic design developed from the research findings. The fundamental principle involved in these instances is the segregation of clear waters with recirculation and reuse of the various process waters wherever possible. Closing up of waste lines in some cases requires clarification or screening before the waters can be reused; other sources are recirculated without solids removal. The excess wastes requiring treatment before discharge are thereby substantially reduced in volume, resulting in lower capital outlay for treatment structures.

By-product recovery of mono-sodium glutamate from Steffens waste has furnished a means of compliance with the limitation prohibiting its discharge to streams. The current market for molasses from the straight house operation has resulted in suspension of Steffens house operation. But in 1942 five of the six plants equipped with the process shipped concentrated wastes after evaporation to the by-product recovery plant located in another state. The remaining plant utilizes the waste as a coagulant in the treatment of factory wastes.

The treatment systems described in the following paragraphs are typical of the way in which pollution is being controlled by the industry.

Coagulation and Settling

The treatment plant at the Monitor Sugar Co. provides screening, grit removal, coagulation and sedimentation for a 5 mgd. flow. When operated as a plain settling process it removes 40 per cent of the B.O.D. and 92 per cent of the suspended solids. Coagulation with Steffens waste amounting to 4 per cent of the waste volume treated gives 60 per cent B.O.D. removal and 95 per cent suspended solids removal. Sludge is disposed of to a lagoon; grit and screenings are used for fill and agricultural purposes. The oxygen demand of the effluent averages slightly less than 5 pounds of B.O.D. per ton of beets.

Recirculation and Controlled Discharge

The recirculation method of control originated at the Blissfield plant of the Great Lakes Sugar Co. It involves quick settling of the flume water and recirculation for fluming of beets. Battery water is passed through a vibrating screen and reused in the beet washer and in the diffusion battery washing system. Pulp press water is substituted for fresh water to form lime slurry which is impounded. Sludge from the flume water clarifier is lagooned and the supernatant is withdrawn during the period of high stream flow in the spring. Steffens wastes are evaporated concurrently for the production of monosodium glutamate and the condensate is handled in the same manner as the clarifier sludges. Wastes to the river during the operating season consist of condenser water carrying 1.8 pounds of B.O.D. per ton of beets.

Cyanide Waste Treatment Plant.
Chevrolet Motor Co., Flint, Mich.

Combined Recirculation and Treatment

At Alma, the Michigan Sugar Co. supplemented its recirculation system with coagulation and clarification of the overflow prior to its discharge to the river. Segregation and reuse in this instance reduced the quantity of wastes requiring treatment from 5 to 1 mgd. Flume water is screened and passed through a grit chamber. A portion is returned to the flumes and the excess is combined with battery water, flocculated and settled. Twenty-five per cent of the Steffens waste volume produced is used for coagulation. The remainder is evaporated. Sludges are placed in a lagoon with press water and lime cake. The supernatant is returned to the treatment process. Operation has produced an effluent meeting the established effluent standards.

CHEMICAL INDUSTRY

Expansion of the industry to locations which were previously unaffected by chemical wastes has raised problems requiring application of control measures for protection of established water supply, commercial fishing and recreational developments.

Erection of plants of the Dow Magnesium Corporation for extraction and processing of magnesium from brine produced waste brines at Ludington and hydrochloric acid wastes at Marysville.

At Ludington the waste brine was pumped through 12 miles of 14-inch diameter steel pipe to an isolated region along the Lake Michigan shore. The point of discharge was some 600 ft. from shore in 12 ft. of water. Observations on the behavior of the wastes disclosed that the brine did not diffuse rapidly but remained on the lake bottom in approximately its original concentration. However, location of the outlet did provide the protection originally contemplated. The brine having a specific gravity of 1.18 accumulated to depths of from one to three feet, but within a month after closing of the plant no trace of the wastes could be found.

At Marysville, the hydrochloric acid wastes evolved from the electrolysis of magnesium chloride were released to the St. Clair River through a submerged multiple outlet pipe on the river bottom. The outlet was so designed for the reaction of acid with river water to effect neutralization to a pH of 6.0 immediately downstream from the disposal section. The quantity of river flow required for this purpose represented about one and a half per cent of the entire 200,000 cubic feet per second of river discharge.

Failure of the system to prevent pollution injury resulted from the substitution of vitrified clay for rubber lined steel pipe during construction. Breaks in the diffusion line developed from time to time and unequal distribution of wastes created zones of high acid concentration. However, on the few occasions when the line was in good repair, satisfactory results were obtained. Sufficient protection was provided for downstream water supplies at all times. Replacement of the distribution line scheduled for late 1944 was postponed by closing of the plant.

The phenol waste treatment plant of the Dow Chemical Co. at Midland

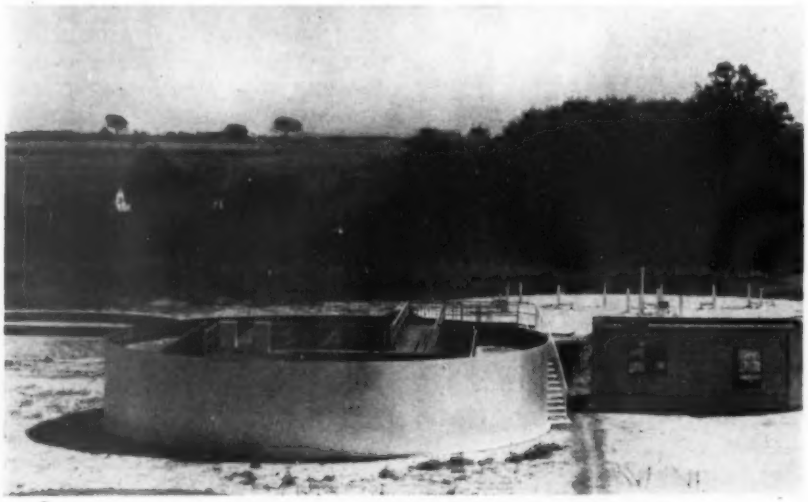
was enlarged, and supplemental treatment provided for the filtered wastes by the activated sludge process. Treatment of general plant wastes, amounting to 50 mgd. and carrying up to 30,000 pounds of B.O.D. by the activated sludge process was started in December, 1945. The plant features a new aerator design developed by the company's waste disposal department. Sloping side walls on the aerator and clarifier tanks is another departure from the standard design of these units.

FOOD INDUSTRY

Absorption and storage lagoons continue to be widely used by the vegetable canning industry. In the past these methods have been objectionable by reason of the intensely obnoxious odors which they produce. Research by the National Canners Assn. has developed a means of controlling these odors in the application of sodium nitrate to the impounded wastes. When sufficient nitrate is applied to satisfy 20 per cent of the oxygen demand, it is found that odors are not noticeable beyond 200 feet from the lagoon area. Use of this method by canneries in Michigan has confirmed these conclusions.

For screening of wastes, the vibrating screen with 40 mesh cloth has found increasing application. These screens have given exceptional service when operating in fruit and vegetable canneries, beet sugar factories and potato dehydration plants.

An outstanding example of solving a waste problem at a profit was demonstrated at a plant manufacturing dextrose from wheat flour. In converting the flour to sugar, some four tons per day of protein was extracted and wasted to the sewer. Expensive treatment was avoided by recovery of 95 per cent of the waste protein for the manufacture of amino products. By-product recovery has now become an essential part of the operating economy.



Mead-Johnson Co. Waste Treatment Plant, Zeeland, Mich.
Mallory process unit for plant waste including whey.

The performance of milk filters has been greatly improved by adoption of principles of recirculation and high rate of application. Removals of B.O.D. as high as 90 per cent have been noted where the plant design provides the following:

1. Holding tank to accommodate 40 per cent of the day's raw waste flow.
2. Filter media 6 feet deep, stone 2½ inch to 3½ inch in size.
3. Rate of application upwards of 12.0 mil. gal./acre/day.
4. Loading—1.0 pound of B.O.D. per cubic yard.
5. Recirculation of raw waste eight times.

Problems from disposal of whey as waste have been materially benefited by a ready market for by-products used for human consumption and poultry food. When treatment is needed, digestion followed by oxidation as practiced at the Mead-Johnson Company in Zeeland still seems to be the best method of producing a high quality of effluent.

The above accomplishments and developments signify that despite the many factors that have retarded progress, pollution control in industry has advanced. Many additional gains are in prospect. Construction plans are ready for corrective measures on a number of long-awaited projects. Current shortages of materials and equipment hold the key to the elimination of current misuses and abuses of our water resources.

Harold Griswold Retires at Hartford

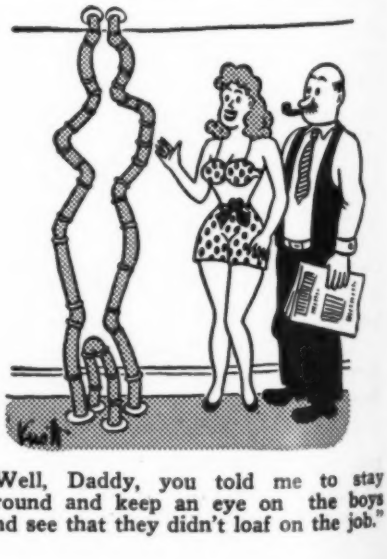
Harold W. Griswold, for the past 18 years Deputy Manager and Deputy Chief Engineer, Water Bureau,

Metropolitan District of Hartford, Conn., has retired. Mr. Griswold's total service with the Hartford Water Bureau was more than 33 years. In 1913 he was appointed as Assistant Engineer, which job he held until 1917-18, when he was Construction Superintendent on work at the Norfolk Navy Yard.

In 1918 Mr. Griswold rejoined the Hartford Water Department as Division Engineer and served as Designing Engineer and Principal Assistant Engineer before being appointed to the position from which he just resigned.

Mr. Griswold is a graduate of the Massachusetts Institute of Technology and served with the U. S. Army Corps of Engineers from 1909 to 1913. He is an immediate past president of the New England Water Works Association and is also a member of A. W. W. A. and A. S. C. E.

Art Finds New Expression



"Well, Daddy, you told me to stay around and keep an eye on the boys and see that they didn't loaf on the job."

MINIATURE INDUSTRIAL WASTE TREATMENT PLANT

By ROY F. WESTON
Sanitary Engineer
WASTE CONTROL LABORATORY
ATLANTIC REFINING CO.
PHILADELPHIA PA.

A CAPACITY waste water flow of five (5) gallons per minute can be practically and efficiently treated in a vest pocket size continuous treatment type plant.

In water pollution as in most things we are so accustomed to thinking in terms of large quantities and dimensions that it is difficult to conceive of that "relative" situation in which a few gallons of waste water may create a serious water pollution problem. Such circumstances are not infrequent in occurrence. In fact, the disposal of waste waters originating from the washing of tank trucks has presented this type of problem to The Atlantic Refining Co.

To minimize evaporation losses and to present a pleasing appearance, the tank, cab and other superstructure parts of company tank trucks are painted aluminum. The substructure is painted a contrasting red. To maintain the effect of this color scheme and to facilitate inspection of critical parts, it is necessary to provide frequent thorough washing and intermediate water rinsing. The cleaning problem is difficult and necessitated considerable research to develop adequate cleaning detergents

The Author

and procedures. A most satisfactory detergent was found in a combination of pine oil, linseed oil soap and Ultrawet. The proper admixture of these ingredients makes a water soluble highly viscous fluid. One pint of this material mixed with one gallon of light fuel oil and four gallons of water forms a volume of emulsion sufficient to cleanse the average truck. This mixture is referred to later as "standard soap solution." The emulsion is applied to the truck with a brush and is rinsed off with water using a high pressure car washer spray nozzle. This procedure produces a waste water of milky appearance, strong pine oil odor and high biochemical oxygen demand containing considerable quantities of fibre, silt, and grit; 2000 to 20,000 parts per million of easily separated discolored oil, small quantities of emulsified oil, soluble soap and insoluble soap curd. The characteristics of waste waters are shown in Table I, II, and IV.

TABLE I

Characteristics of an Average Waste Water

(Laboratory Mix)

Item	Concentration
Oil (ppm.)	7,230
Turbidity (ppm.)	537
pH	8.5
Alkalinity* (ppm. as $CaCO_3$)	14
Oxygen consumed (ppm.)	460
Biochemical oxygen demand	778
Odor	7,400
Toxicity to fish† (Lepomis macrochirus-bluegill sunfish)	Pct.
24-hour median tolerance limit (20°C.)	8.6
48-hour median tolerance limit (20°C.)	8.1
Safe dilution (20°C.)	2.1

Note: Average waste water is a 1 to 27 dilution of "Standard Soap Solution."

*Alkalinity added to the water by the soap.

†The fish tests were conducted in accordance with the procedures of Hart, Doudoroff and Greenbank. "The Evaluation of Industrial Wastes, Chemicals and Other Substances to Fresh Water Fishes," The Waste Control Laboratory, The Atlantic Refining Company, Philadelphia, Pennsylvania, 1945.

The mean size of the fish was 8 cm. with a minimum of 6 cm. and a maximum of 9 cm.

The test solutions were aerated using a special inverted funnel type apparatus with a pure oxygen interface such that sample turbulence was an absolute minimum.

Quantity of Waste

Each truck is washed once a week using this "standard soap solution" so the quantity of polluting materials discharged from a given truck servicing station depends on the number of trucks stationed at that site. The rate of discharge of waste water is controlled by the capacity of the car washer spray nozzle. In all cases the capacity discharge is

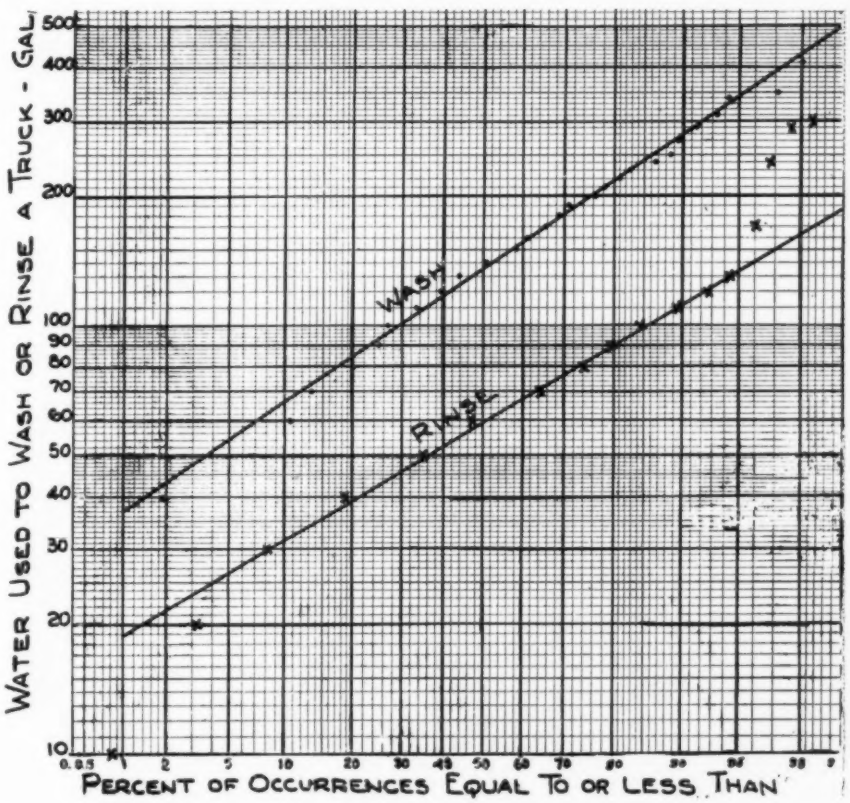


Fig. 1. Water Used in Washing or Rinsing Trucks.

TABLE II
Laboratory Results of Treating Truck Washing Wastes

Sample	Item	Treatment: Plain Settled 2 Hours	Plain Settled and Filtered	Alum Treated and Settled 2 Hrs.	Alum Treated, Settled and Filtered
Standard Soap Solution diluted 1 to 5 with Exton Well Water	Turbidity (ppm.)	620	290	36	2
	Oil (ppm.)	224	49	6	2
	Odor threshold	1,000	...	...	400
	B.O.D. (ppm.)	779	687	646	422
	pH	8.40	...	6.15	7.8
Standard Soap Solution diluted 1 to 15 with Exton Well Water	Turbidity (ppm.)	265	88	20	2
	Oil (ppm.)	78	21	6	2
	Odor threshold	...	...	...	...
	B.O.D. (ppm.)	491	294	424	203
	pH	8.15	...	5.75	...
Standard Soap Solution diluted 1 to 30 with Exton Well Water	Turbidity (ppm.)	102	23	28	1.5
	Oil (ppm.)	36	10	7	2
	Odor threshold	400	...	...	100
	B.O.D. (ppm.)	408	196	263	101
	pH	8.00	...	5.65	...
Gloucester 3/26/42 No. 1 Grab Sample	Turbidity (ppm.)	275	46	145	1
	Oil (ppm.)	95	24	79	1
	Odor threshold	...	...	...	...
	B.O.D. (ppm.)	756	520	555	416
	pH	7.25	...	4.25	...
Gloucester 3/26/42 No. 2 Grab Sample	Turbidity (ppm.)	460	66	110	1
	Oil (ppm.)	69	48	41	1
	Odor threshold	...	...	...	...
	B.O.D. (ppm.)	562	256	267	175
	pH	7.35	...	4.30	...

Note: All wastes were treated with 95.2 ppm. alum as Al_2O_3.

Standard soap solution diluted 1 to 7.5 with U. S. mean water: Toxicity to fish (Lepomis Macrochirus-Bluegill sunfish)
1. 24-hour median tolerance limit (20°C.) ..... 16 %
48-hour median tolerance limit (20°C.) ..... 16 %
Safe concentration (20°C.) 4.8%

Standard soap solution diluted 1 to 30 with U. S. mean water: Toxicity to fish (Lepomis Macrochirus-Bluegill sunfish)
2. 24-hour median tolerance limit (20°C.) ..... 62 %
48-hour median tolerance limit (20°C.) ..... 62 %
Safe concentration (20°C.) 18.6%

1. 110 ppm. Al_2O_3 used for coagulation.
2. 70 ppm. Al_2O_3 used for coagulation.
The fish testing conditions and procedures were as outlined in Table I.

approximately five gallons per minute. The quantity of water used in washing a truck is shown in Fig. 1.

In between the weekly washing job it is usually necessary to rinse the truck, using water only, to remove accumulations of dust, mud, or snow and ice. This waste water may contain very large quantities of silt and grit. The capacity rate of discharge is also about 5 gpm. A truck may be rinsed as often as twice a day. The quantity of water used in rinsing a truck also is shown in Fig. 1.

The total quantity of waste water produced at any terminal is small because there are but few terminals at which more than three or four trucks are washed in any one day. It frequently is the case, however, that the servicing terminal is located on the head waters of a favorite trout stream that also may be used as a source of stock or domestic drinking water supply. In these cases sportsmen, farmers and vacationers will not tolerate visual, odorous, or toxic evidences of pollution so a high degree of treatment is required prior to discharge to the stream. Since the quantity of waste produced is so small, the reader probably wonders why the problem is not solved by the simple expedient of absorption into the soil. This was tried. Experiences with the failure of absorption wells and tile fields handling settled wastes proved that the same degree of treatment was required for economical disposal to the soil as was required for disposal to natural waters. Obviously the economic advantage rests with disposal to surface waters so absorption wells or fields are provided only where no other method of disposal is available.

Laboratory and Field Experiments

The number of cases in which a high degree of treatment was required warranted a comprehensive study of the problem and a standardization of treatment equipment. Laboratory preparations and field samples were treated using sedimentation, sedimentation plus filtration, and chemical coagulation plus filtration. Both laboratory and plant results indicated that sedimentation only or sedimentation plus filtration did not provide a sufficiently high degree of treatment, (typical data of such treatment are shown in Table II); consequently attention was centered on chemical treatment. Results of a systematic series of investigations indicated that best results could be obtained with floc flotation rather than sedimentation using potassium permanganate as a coagulant. On the basis of these results, several chemical treatment plants were installed for the batch treatment of accumulated wastes using permanganate as the treating agent. Cloth filters were used for clarifying the treated effluent. Field results soon indicated that the degree of clarification obtained using permanganate was entirely satisfactory, but that the process of batch treatment was not sufficiently flexible to assure satisfactory treat-

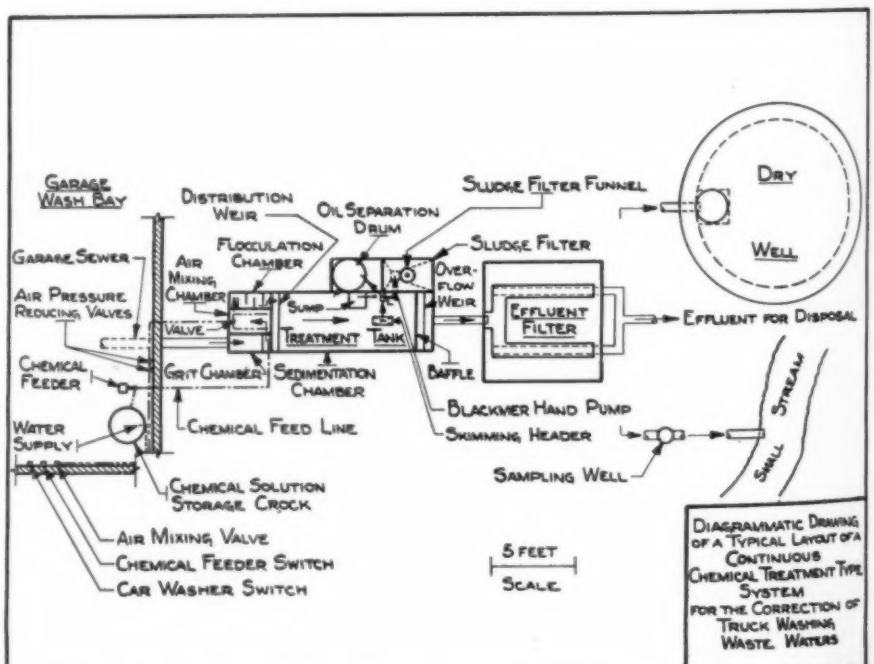


Fig. 2. Typical Layout of Continuous Type Treatment Plant.

View of Miniature Waste Plant Installation.

ment procedures and results and that cloth filters were inadequate for the requirements of treated water quality.

Continuous Treatment

When the limitations of the batch-treatment, cloth-effluent-filter installations became apparent a design was prepared for continuous treatment of the waste. A diagrammatic drawing of a typical layout is shown in Fig. 2. The treatment plant was designed for a capacity flow of five gpm. A treatment tank 12 ft. long and 3½ ft. wide included a grit chamber; air mixing chamber; and around-the-end baffle-type flocculation chamber, each providing a five-minute detention period; and a sedimentation chamber providing a two-hour detention period.

The auxiliaries to the treatment tank included: (1) A Wilson Pulsafeeder of 0 to 3 gal. per hour capacity and a 20 gallon earthenware crock for chemical storage; (2) A perforated pipe air-distributor for the air mixing chamber, control valves and two pressure reducing valves so that standard air compressor equipment at the terminals could be used for air supply; (3) a Blackmer hand pump with connections to an oil skimming funnel and alternate connections to a sump in the sedimentation chamber for pumping oil skimmings and sludge; (4) an oil drum, with a drain to the sedimentation chamber, for the collection and separation of the oil-floc-water skimmings, (Blackmer pump connections to this drum made it possible to pump the oil to other drums for disposal); (5) 30-inch square sludge filter for dewatering sludge accumulations.

An effluent filter designed on the basis of 0.1 gpm. per square foot was provided for polishing the effluent. The filter media, from top to bottom, consisted of 3 inches of spent filter clay (a waste product from the refining of lubricating oils), 4 inches of sand, and 4 inches of pea gravel over the filter drains. The control switch for the chemical feeder and the control valve for the

TABLE III

Laboratory Results Indicating the Influence of Hardness of Dilution Water and Dilution of Standard Soap Solution on the Uniformity of the Results of Treatment

Dilution Water	Dilution of Standard Soap Solution	Characteristics of Treated Water Turbidity	pH
Distilled.....	1:25	8.0	4.8
1/20 U. S. Mean..	1:25	26.0	4.5
1/10 U. S. Mean..	1:25	12.0	4.6
1/ 5 U. S. Mean..	1:25	3.5	4.8
1/ 2.5 U. S. Mean..	1:25	1.0+	6.2
1 U. S. Mean..	1:25	1.0	6.4
1/ 2 U. S. Mean..	1:50	26	4.5
	1:25	6	4.5
	1:12.5	5	4.5
	1: 6.25	3.5	4.5
	1: 3.125	2.5	4.6
	1: 1.67	1.0	4.8

Note: All samples were treated with alum equivalent to 140 ppm. Al_2O_3. (This was an over-treatment).
All samples were filtered through 3 inches of spent clay.

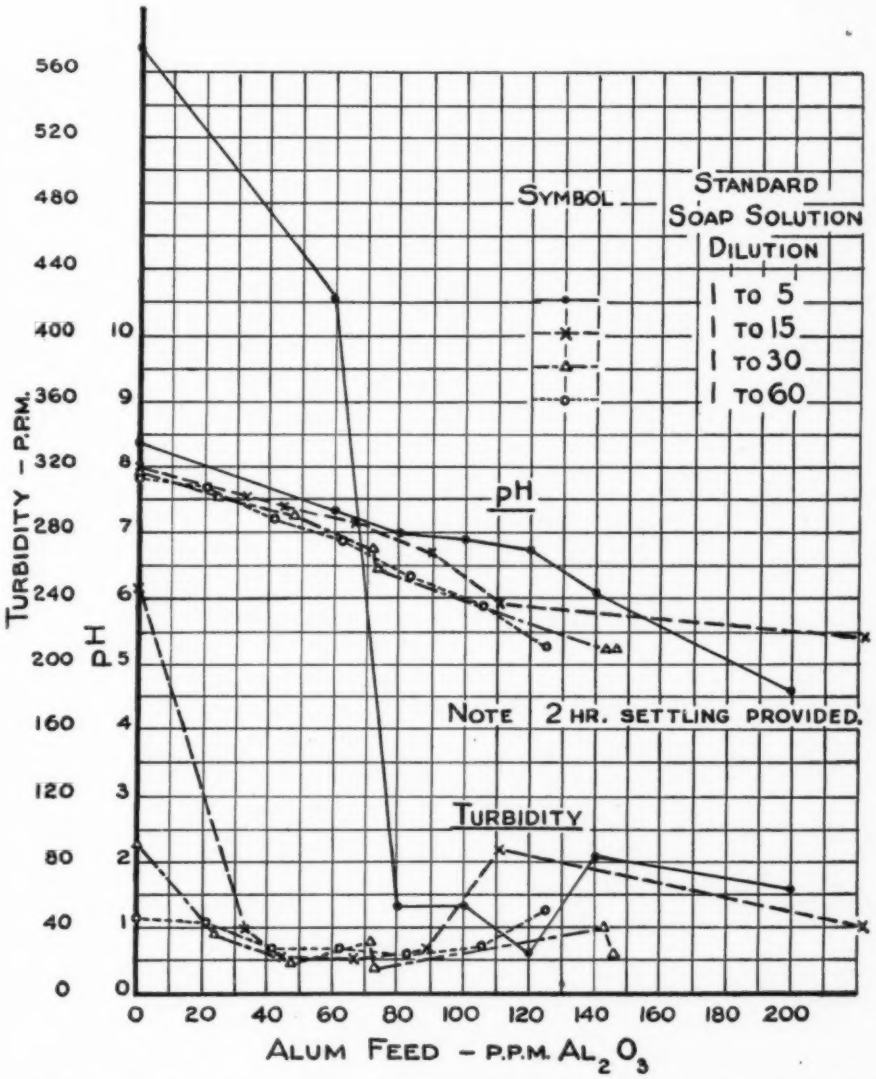

SYMBOL
STANDARD SOAP SOLUTION DILUTION
1 TO 5
1 TO 15
1 TO 30
1 TO 60
pH
NOTE 2 HR. SETTLING PROVIDED.
TURBIDITY
TURBIDITY - P.P.M.
pH
ALUM FEED - P.P.M. Al_2O_3
0 20 40 60 80 100 120 140 160 180 200
560 520 480 440 400 360 320 280 240 200 160 120 80 40 0
10 9 8 7 6 5 4 3 2 1 0

Fig. 3. Effect of Alum Dosage on Truck-Washing Waste Water Emulsions (Sedimentation only).

air supply were located next to the control switch for the car washer, and a reminder sign was placed at this location so that the treatment plant would be placed in operation every time the car washer was used for washing or rinsing. The installation costs for these plants, using steel construction for the treatment tank, was $2625 or less.

Coagulation with Alum

War industry demand for potassium permanganate made it necessary to find a substitute material. Investigations demonstrated that filter alum would give satisfactory results with floc flotation, over a wide range of operating conditions (see Fig. 3 and Tables II, III, and IV). Plant observations made by the Pennsylvania Department of Health on a unit using filter alum as a coagulant are published with their permission in Table IV. The treatment results obtained in actual plant operation are better in the removal of B.O.D. and odor, and probably are better in the removal of materials toxic to fish than those obtained in the laboratory.

Excellent results in the removal of toxicity are in evidence at the Exton, Pa. Plant where the treated waste water effluent discharges into a side channel "hole," of about 50 gallons capacity, of a very small creek. This "hole" is continuously inhabited by minnows. The better results obtained in plant practice are probably due to biological activity because extensive biological growths occur in all systems handling these wastes.

These miniature waste treatment plants are operated by the regular terminal operating personnel. A complete set of operating instructions describing the function of each part of the plant and the care and maintenance required is provided for each installation. In addition, a definite schedule is prepared indicating the item of operation involved, the day it is to be attended to, and the responsible individual. The time required for the care of such plants averages about 15 hours per month.

The by-products of treatment have presented no difficult disposal problems. The oil-floc accumulations have been disposed of as slop-oil, used for killing weeds, or burned depending on local conditions. The dewatered sludge accumulations from the treatment tank and the scrapings from the surface of the effluent filter are sufficiently oil free that they have been disposed of as dump material. It is estimated that the operating costs, exclusive of labor, are about 2 to 3 cents per truck washed or rinsed.

Several years' experience has demonstrated that the operation of these miniature industrial waste treatment plants is entirely satisfactory and practical.

TABLE IV

Results of Treating Truck Washing Wastes
Exton, Pa.

MARCH 17, 1943*

Item as ppm.	Raw Waste	Composite Samples—Set. No. 1 Waste After Chemical Flocculation & Sedimentation	Composite Samples—Set. No. 1 Waste After Flocculation, Sedimentation & Filtration	Per Cent Reduction
Color	Soapy Gray	50	50	....
Odor	Pine Oil—very strong	Pine Oil—faint	Gasoline—faint	....
Turbidity	10,000	250	80	99.2
Total dissolved solids	2,320	1,250	380	83.5
Volatile dissolved solids	960	380	100	89.6
Fixed dissolved solids	1,360	870	280	79.4
Total suspended solids	2,840	70	80	97.2
Volatile suspended solids	960	50	60	93.8
Fixed suspended solids	1,880	20	20	98.9
pH	10.5	4.3	8.6	....
Oxygen consumed	2,760	410	18	99.3
Alkalinity, total	888	14	240	....
Alkalinity, carbonate	824	...	68	....
Alkalinity, bicarbonate	64	...	172	....
B.O.D. (5 days)	Not detr.	Not detr.	60	....
Ether soluble	7,030	Not detr.	Not detr.	....
Oil	Floating on sample	None apparent	None apparent	....

Set No. 1—Composited from samples collected at 10-minute intervals during washing operations of first truck.
First truck washing began at 12:45 p.m.—completed 2:00 p.m.

Item as ppm.	Raw Waste	Composite Samples—Set. No. 2 Waste After Chemical Flocculation & Sedimentation	Composite Samples—Set. No. 2 Waste After Flocculation, Sedimentation & Filtration	Per Cent Reduction
Color	Soapy Gray	60	30	....
Odor	Oily—very strong	Oily—faint	Gasoline—distinct	....
Turbidity	10,000	400	30	99.7
Total dissolved solids	2,400	1,600	360	85.0
Volatile dissolved solids	1,400	580	140	90.0
Fixed dissolved solids	1,000	1,020	220	78.0
Total suspended solids	3,580	115	80	97.8
Volatile suspended solids	1,380	60	70	94.9
Fixed suspended solids	2,200	55	10	99.6
pH	9.0	4.2	7.5	....
Oxygen consumed	2,900	440	16	99.5
Alkalinity, total	537	8	270	....
Alkalinity, carbonate	450	...	...	....
Alkalinity, bicarbonate	87	...	...	....
B.O.D. (5 days)	Not detr.	Not detr.	13	....
Ether soluble	15,230	Not detr.	Not detr.	....
Oil	Floating on sample	None apparent	None apparent	....

Set No. 2—Composited from samples collected at 10-minute intervals during washing operations of 2nd and 3rd trucks.
Second truck washing began at 2:00 p.m.
Third truck washing completed 3:45 p.m.

Note: At the start of this survey the chemical mixing and sedimentation compartments of the treatment works were completely filled with partially treated wastes from previous truck washing operations carried out prior to the survey.

Acknowledgment: Above data is published by courtesy of the Pennsylvania Department of Health. The sampling and analytical work was performed by their personnel.

SOME THOUGHTS ON CONTROLLING INDUSTRIAL WASTES

Developed from Notes and Records in the Author's Notebook

By H. MALIN
Waterworks and San. Insp.
CITY ENGINEERING DEPT.
WINNIPEG, CAN.

The author's accompanying article is founded on actual experiences and shows how to make a common sense approach to difficult industrial waste pollution problems.

Fortunately, not all workers in this field meet with the resistance Mr. Malin has experienced in Winnipeg, but whatever the attitude of industry, Mr. Malin's rules are good. The satisfaction of accomplishment in the solution of an industrial waste problem is worth any effort expended.

THE population in areas served by modern sewage works takes pride in the steps taken to provide them with a safe and sanitary way to dispose of wastes which previously polluted streams, rivers and lakes. Residents of such communities are loud in their praises of the system to members of communities not served by such facilities, but they also never miss an opportunity to pass a few scathing remarks concerning the odors which sometimes emanate from the sewage treatment plant, or from the interceptors which feed the sewage into the plant. The chief complaint often is that in spite of an "expensive" treatment plant, odors still exist.

The reason is quite simple, and the answer while also very simple is quite a problem and one big headache to those whose task it is to track down the causes, then spend endless time trying to effect a cure. The answer to the major portion of the problem is industrial wastes.

In an effort to curb the practice of allowing anything and everything to be dumped into the sewers, governing bodies have amended old by-laws or passed new ones prohibiting certain wastes from being discharged into sewers. Passing a by-law is one thing, enforcing it, probably at considerable expense to an industry or municipality, is another.

Industry's Attitude

Industrialists who in the past have been in the habit of dumping all wastes into the sewer do not take kindly to any suggestion which means it will be necessary for them to keep certain wastes from entering the sewer. They sometimes become rather abusive and want to know why they are being singled out for such treatment, especially in view of the fact that sewer rental charges in their opinion are far from reasonable.

On this point it would be reasonably safe to say that during the past six years we have not met the head of an industrial plant who has been willing to suggest that we sit down and discuss the matter the first time he is approached on the subject.

At times it has been very difficult to remain on an even keel while listening to a tirade against all officials connected with sewage disposal, and ourselves in particular, for having dared to invade the sacred portals of his plant to expound such exaggerated ideas.

To say that these remarks just bounce off us because we are thick-skinned would be untrue; they really hurt, and a spontaneous scathing reply would only aggravate the situation, making a second interview more difficult. These interviews usually end by requesting permission to go into the plant in order to study their method of processing with a view to finding a way out of a serious situation. This is usually given very reluctantly; however, it is the gateway to further interviews, consequently we accept it gratefully.

Inspecting the Plant

In order to make a thorough inspection of the plant, one is invariably left in the care of the plant superintendent and the chief engineer, who have more problems than is known, and usually not appreciated by the management, who are only concerned in production costs and output. In the presence of these two gentlemen we have found someone like ourselves, someone who has problems and is looking for advice.

At this point it is well to forget one's own problems and concentrate on theirs. More often than not a stranger looking over the plant can spot some little thing which would help, and any suggestion which appears logical is given consideration. Whether it works or not is not so important; the main thing is you have found two people who appreciate the fact that you are showing more than a passing interest in their problems.

Be patient, and when the time comes for your suggestions in re: keeping deleterious wastes from the sewer, you will find you have the co-operation of these two gentlemen.

During this period we try to discover difficulties experienced in their local sewer system, problems of water supply, what their wastes consist of, and the relative cost of maintenance due to industrial wastes.

It is now time to know more about the industry and time should be taken to study the process. There are several very good publications available which give a very clear picture of industrial processes in plain simple language. It is really surprising how a study of various plants shows up the terrific waste. Products which have a commercial value are being discharged into sewers, creating endless trouble to sewage disposal officials, also adding to production costs through wastage, or maintenance costs in many cases due to these same wastes.

Cooperate With Industry— It Pays

Plant superintendents and engineers are very human, and as such are susceptible to try any idea which will show a saving particularly in reclaiming wastes. The segregation of these wastes is more often than not a very tedious and sometimes difficult proposition; however, if it really appears worth while it can be accomplished with the co-operation of these two gentlemen.

In co-operation with them and through frank discussions, ways can be devised and equipment often made in the plant to handle these wastes at a fairly reasonable cost. These wastes can often be reclaimed and processed in the plant. Such reclaimed waste may have a good com-

mercial value, or failing in this, may be sold to another industry to be processed. Many such installations are working very efficiently.

Let us assume we have been successful in getting our ideas working satisfactorily. We again interview the manager and find he is a much different person from the one we first met. He is friendly and goes on to explain that due to certain changes made in the plant there should be no further trouble with their wastes, and how by doing a little research, they, that is he and his staff, have found a way out of a bad situation; in fact, due to these changes their wastes are now worth money.

We listen intently to these words and experience a deep feeling of satisfaction at the results of our efforts. We have accomplished our assignment in this plant, but best of all, we have made some good friends on whose co-operation we can count in the future.

A Few Simple Rules

Experience in this field of operation has shown that a few simple lines of procedure are very essential if an assignment is to be satisfactorily completed without resorting to legal procedure. Such legal proceedings only tend to antagonize a person and spoil any chances for future co-operation.

First—Be a good listener in the early stages of the problem, absorb every detail rather than to try thinking ahead for an answer.

Second—Do not try to rush things; a carefully planned effective method of control is much to be preferred than a haphazard method of experimenting.

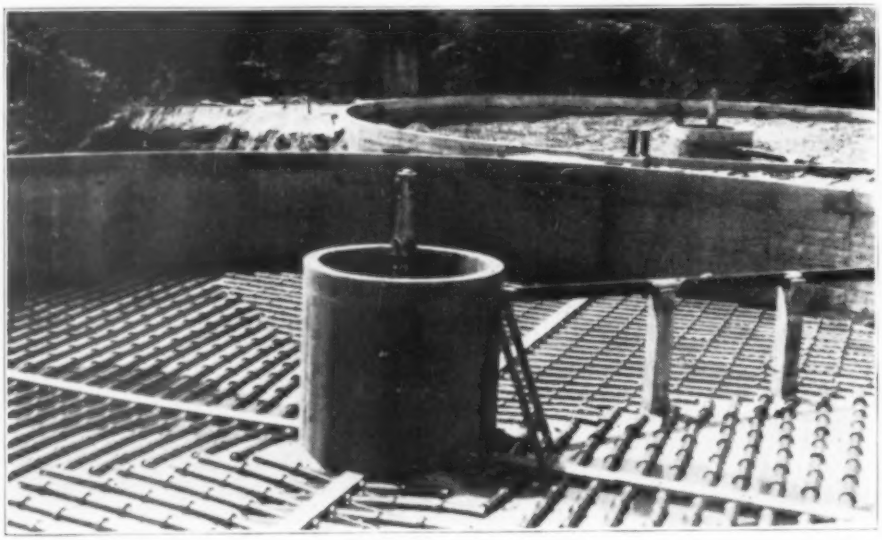
Third—Consider the problems of those with whom you are working. It creates confidence and good will.

Fourth—Be sure to study the method of processing in any plant before making any suggestion. People like to know that you have sufficient interest in their industry to warrant a study of it.

Fifth—Remember that executive heads of industries are plain business men who have innumerable problems of their own and do not take kindly to suggestions calling for added expenditures unless some benefit can be shown in return.

Sixth—While by-laws can be enforced legally, this procedure should only be used as a final resort. We prefer to regard a by-law as our authority to investigate. Experience has proved that more can be accomplished by personal effort than by quoting a by-law, then trying to enforce it.

Simple and Economical Underdrain Design



Shown here is a simple method of underdraining trickling filters. This filter bottom at Rotterdam, N. Y., consists of perforated inverted clay channel pipe. The designers found this perforated clay pipe to be more economical then the block-type underdrain and consider it just as efficient

H. Hobart Porter Dies

Board Chairman American Water Works & Electric Co.

H. Hobart Porter, chairman of the board of American Water Works & Electric Co., died recently in his 82nd year. A graduate in 1886 of the Columbia Univ. School of Mines, with a degree in mining engineering, Mr. Hobart's early years were spent in the mining industry in Mexico, Arizona and other southwestern states. Later be became connected with the Westinghouse Elec. & Mfg. Co., and in 1896 founded, with the late E. N. Sanderson, the engineering firm of Sanderson & Porter, from which he retired a few years ago after almost a half century of active association.

In 1914 Mr. Porter was elected president of the American Water Works & Electric Co., and held that office until 1937 when he was elected to the board chairmanship which position he held at the time of his death. It was under Mr. Porter's leadership that the large electric system owned by the American Water Works & Electric Co. was formed and integrated into an operating unit.

Mr. Porter was active in many organizations and associated with a number of industrial firms as a director, and at one time had been president of the Village of Lawrence, L. I. He held honorary degrees from Hobart College and from Rennselaer Polytechnic Institute.

Chlorine Institute Holds Annual Meeting

Re-elects S. W. Jacobs as President and R. T. Baldwin as Secretary

The Chlorine Institute, Inc., held its 23rd Annual Meeting in New York City on Jan. 29, 1947, at which S. Willard Jacobs, President of Niagara Alkali Co., was re-elected president, E. C. Speiden, Pres., Innis Speiden & Co., was re-elected vice-present, and Robert T. Baldwin, secretary and treasurer. Mr. Baldwin has held this position ever since the Institute was organized in 1924.

The following were elected members of the Institute's Board of Directors for the customary 2 year term:

Thomas Coyle—E. I. duPont deNemours & Co.
W. I. Galliher—Pittsburgh Plate Glass Co.
E. W. Haley—Southern Alkali Corp.
L. Neuberg—Westvaco Chlorine Products Corp.
E. E. Routh—The Mathieson Alkali Works, Inc.
B. P. Steele—Pennsylvania Salt Mfg. Co.

The hold-over directors are:

George M. Dunning—Wyandotte Chemicals Corp.
F. W. Fraley—Diamond Alkali Co.
R. W. Hooker—Hooker Electrochemical Co.
S. W. Jacobs—Niagara Alkali Co.
E. C. Speiden—Innis, Speiden & Co.

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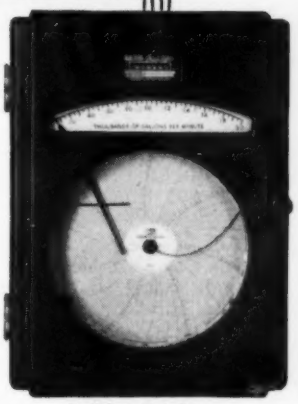

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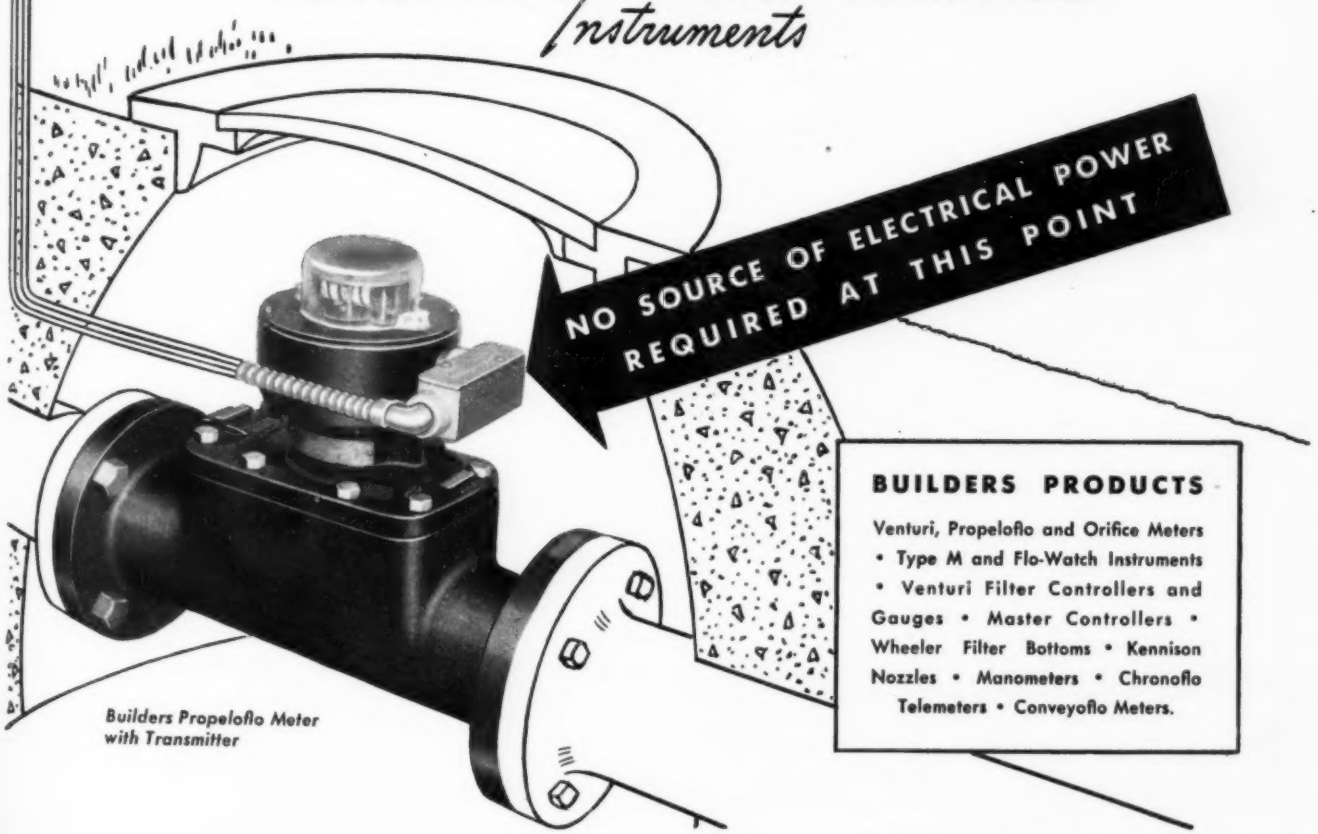
Instruments



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MEETINGS SCHEDULED

Mar. 19-21—TRENTON, N. J. (Stacy-Trent Hotel)
New Jersey Sewage Works Association. Sec'y-Treas., M. S. Kachorsky, P. O. Box 283, Manville, N. J.

Mar. 20—BOSTON, MASS. (Statler Hotel)
New England Water Works Association. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

Apr. 3-5—CLEMSON, S. C. (Clemson College)
South Carolina Water & Sewage Works Assn. & Short School. Sec'y, D. F. Frick, 418 State Office Bldg., Columbia, S. C.

Apr. 7-10—CHICAGO, ILL. (Palmer House)
The National Ass'n of Corrosion Engineers, Exec.-Sec'y, A. B. Campbell, 711 Main St., Houston, Texas.

Apr. 10-11—BUFFALO, N. Y.— (Statler Hotel)
New York Section A.W.W.A. (Spring Meeting.) Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York.

Apr. 11-12—LINCOLN, NEB. (Cornhusker Hotel)
Nebraska Section A.W.W.A. (Organization Meeting.) Sec'y, J. W. Kruse, City Hall, Lincoln 8, Neb.

Apr. 14-16—MONTREAL, CAN. (Mount Royal Hotel)
Canadian Section A.W.W.A. Sec'y-Treas., A. E. Berry, Parliament Bldgs., Toronto, Ont.

Apr. 14-16—FAYETTEVILLE, ARK. (Engineering Bldg., Univ. of Arkansas)
Arkansas Water and Sewage Works Assn. Sec'y, Harrison Hale, University of Arkansas, Fayetteville, Ark.

Apr. 17—NEW HAVEN, CONN. (Lawn Club)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

Apr. 17-18—CHICAGO, ILL. (Congress Hotel)
Illinois Section A.W.W.A. Sec'y-Treas., H. A. Tolburg, 2020 S. Fifth St., Springfield, Ill.

Apr. 23-24—HAVRE, MONTANA (Havre Hotel)
Montana Sewage Works Association. Sec'y-Treas., H. B. Foote, State Board of Health, Helena, Mont.

Apr. 25-26—HAVRE, MONTANA (Havre Hotel)
Montana Section A.W.W.A. Sec'y, C. W. Brinck, State Board of Health, Helena, Mont.

May 5-6—ANN ARBOR, MICH. (Univ. of Michigan, School of Public Health)
2nd Inservice Training Course for Water Works Personnel. Director, H. E. Miller, Univ. of Michigan, Ann Arbor, Mich.

May 7-9—INDIANAPOLIS, IND. (Antlers Hotel)
Indiana Section A.W.W.A. Sec'y, Charles H. Bechert, 200 Underwriters Bldg., Indianapolis 4, Ind.

May 15-16—WASHINGTON, D. C. (Hamilton Hotel)
Maryland-Delaware Water & Sewerage Assn. Sec'y-Treas., E. Virginia Gipe, State Dept. of Health, 2411 N. Charles St., Baltimore, Md.

May 15-17—VICTORIA, B. C. (Empress Hotel)
Pacific Northwest Section A.W.W.A. Sec'y, Prof. Fred Merryfield, Oregon State College, Corvallis, Ore.

May 21-22—LAFAYETTE, IND. (Memorial Union Bldg., Purdue Univ).
Third Industrial Waste Utilization Conference. Gen. Chairman, Prof. Don E. Bloodgood, Purdue University, Lafayette, Ind.

May 22—MANCHESTER, N. H. (Country Club)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

(*Continued on page* 76)

It's New . . .

HAYS "DUO-STOP"

A Combination Corporation Stop and Saddle That's Simpler to Apply, Stronger in Service

Write for Folder 105

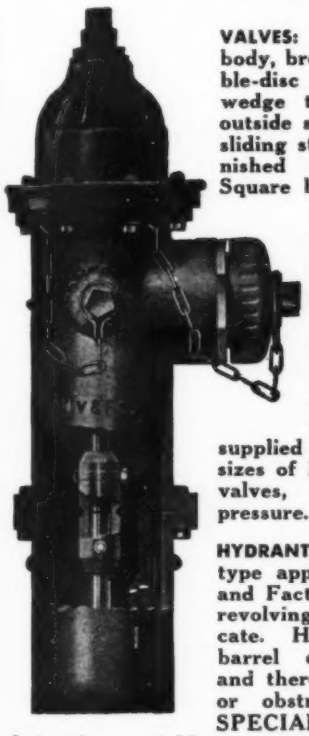
COPPER BRASS LEAD IRON
HAYS WATER WORKS PRODUCTS
HAYS MANUFACTURING CO., ERIE, PA.

NINE IMPORTANT ADVANTAGES of the New HAYS "DUO-STOP" and Pipe Saddle

- The new Hays "Duo-Stop" makes possible a quick, simple, and safe installation of corporation stops on small mains of 2" size, where the small diameter and the thin wall make it impractical to tap the main.
- The "Duo-Stop" is strapped securely and permanently to the main, the stop is opened, and the hole is drilled, by a drilling machine inserting the drill through the stop.
- The installation may be made while the main is under water pressure - - Thus no shutdown of service.
- There is no threaded connection in the Pipe Saddle Shut-Off; stop and service clamp are one piece, solid rust-proof bronze, pressure tight and leakless.
- The extra strength, secured by one-piece construction and reinforced ribbed design, prevents distortion due to strain of strapping, or of outside stresses, and assures perfect functioning.
- The lead gasket provides a tolerance that guarantees a tight fit on either cast iron or steel service mains.
- The 2" "Duo-Stop" Saddle is designed for use on either 2" cast iron or steel pipe.
- The fact that service clamp and stop are cast in one piece simplifies purchasing and stock-keeping. Eliminates necessity of purchasing as separate items.
- Outlets for all types of services.

Dependable!
Rugged!

VALVES
HYDRANTS



VALVES: A.W.W.A. type, iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

Hydraulically Operated: For remote control of operation and for quicker, easier opening or closing. Can be supplied in any of the standard sizes of M & H A.W.W.A. gate valves, either high or low pressure.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

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FIRE HYDRANTS	SHEAR GATES
GATE VALVES	MUD VALVES
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TAPPING SLEEVES	FLANGE AND FLARE FITTINGS
CHECK VALVES	FLANGED FITTINGS
FLOOR STANDS	B & S FITTINGS
EXTENSION STEMS	CUTTING-IN TEES

M & H VALVE
AND FITTINGS COMPANY
ANNNISTON, ALABAMA

Hooker Chlorine
A Multipurpose Chemical in Sewage Treatment

You who have the responsibility of sewage disposal as well as water sterilization will find Hooker Chlorine a multipurpose ally in making your work easier and your results better.

Sewage officials are using chlorine in many phases of sewage treatment to good effect. Chlorination of effluent is not only reducing bacteria count, but where residual is maintained at 0.5 to 1.5 ppm, indications are that there is a decided improvement in the quality of the water in which the effluent is discharged.

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Hooker chlorine whether for sewage treatment or for water sterilization, is of the same uniform high quality that has been protecting water supply for over a quarter of a century. Hooker's Technical Staff, too, is at your service on problems involving the handling of chlorine and the other Hooker Chemicals. For assurance of consistent high quality specify Hooker Chlorine.

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Chlorine
Caustic Soda Muriatic Acid

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SERVICE LEADS

NEW
hand held
Model LHH-2

Bores 2-inch open hole 30-50 feet. Reams to 3½ and 4½ inches.

3.2 Horsepower!... on 90 lbs. air

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EARTH BORING TOOL
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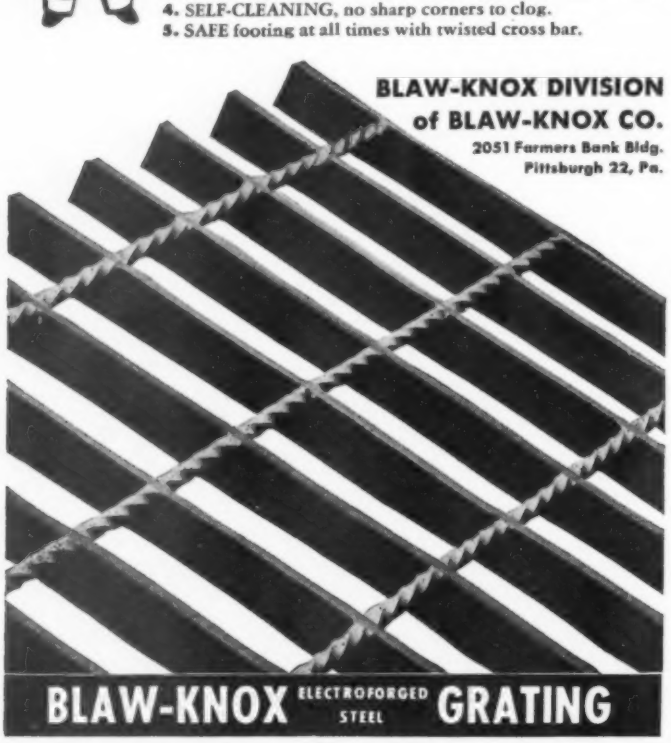


BLAW-KNOX ELECTROFORGED STEEL GRATING

MEETINGS SCHEDULED

(*Continued from page* 74)

May 26-27—ALBANY, N. Y. (Hotel Ten Eyck) (Joint Meeting)
New York State Sewage Works Association. Sec'y, A. F. Dappert, State Dept. Health, Albany, N. Y.
New England Sewage Works Association. Sec'y, W. E. Merrill, 511A State House, Boston, Mass.

June 12-14—UNIVERSITY, ALA. (University of Alabama)
Alabama Water & Sewage Association. Alex O. Taylor, Director of Eng. Extension Service, Ala. Polytechnic Institute, Auburn, Ala.

June 19—BOONTON, N. J.
N. J. Section A.W.W.A. Outing. Sec'y, C. B. Tygert, Box 178, Newark, N. J.

July 21-25—SAN FRANCISCO, CALIF. (Auditorium)
American Water Works Association 1947 Conference. Executive-Secretary, Harry E. Jordan, 500 Fifth Ave., New York 18, N. Y.

July 22-24—SAN FRANCISCO, CALIF. (Auditorium)
Federation of Sewage Works Associations. (20th Annual Meeting.) Executive-Secretary, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.
(Meetings and Exhibits in the Auditorium.) Application blanks for hotel accommodations may be obtained from the respective Association Headquarters.

Aug. 25-27—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Sewage Works Assn. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa.

Aug. 27-29—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Assn. Sec'y, I. M. Glace, 1001 Front Street, Harrisburg, Pa.

Sept. 16-19—BOSTON, MASS. (Statler Hotel)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

Sept. 17-19—ATLANTA, GA. (Ga. School of Technology)
Annual Water & Sewage School. Sec'y, Van P. Enloe, Rt. 5, Box 363, Atlanta, Ga.

Sept. 18-20—BAY CITY, MICH.
Michigan Section A.W.W.A. Sec'y, R. J. Faust, State Dept. of Health, Lansing, Mich.

Sept. 22-24—LOUISVILLE, KY.
Kentucky-Tennessee Section A.W.W.A. Sec'y, R. P. Farrell, 420 6th Ave., N., Nashville 3, Tenn.

Sept. 30-Oct. 1—COLUMBUS, OHIO.
Ohio Section A.W.W.A. Sec'y-Treas., F. P. Fischer, 812 Perry Payne Bldg., Cleveland, Ohio.

Oct. 9-11—CEDAR RAPIDS, IOWA.
Iowa Section A.W.W.A. Sec'y-Treas., H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.
(Joint meeting with)
Iowa Sewage Works Assn. Sec'y-Treas., Robert D. Mott, Iowa City, Iowa.

Oct. 13-15—AMARILLO, TEXAS. (Hotel Herring)
Southwest Section A.W.W.A. Sec'y-Treas., L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

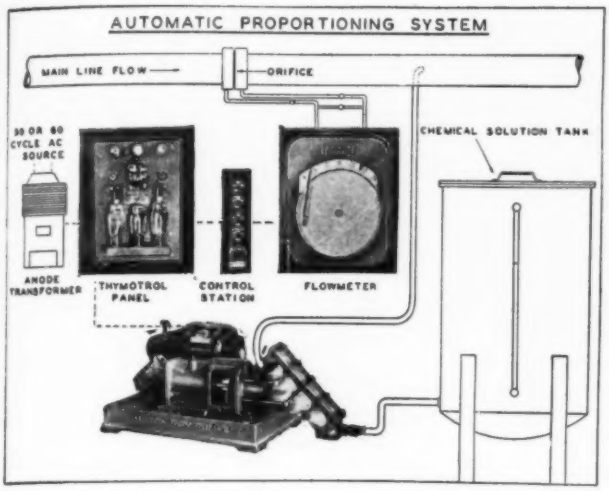
Nov. 3-5—ATLANTA, GA. (Biltmore Hotel)
Southeastern Section A.W.W.A. Sec'y, W. T. Linton, State Board of Health, Wade Hampton Office Bldg., Columbus, S. C.

Nov. 6-8—ATLANTIC CITY, N. J. (Hotel Claridge)
New Jersey Section A.W.W.A. Sec'y-Treas., C. B. Tygert, Box 178, Newark, N. J.

Nov. 17-18—ROANOKE, VA. (Hotel not selected)
Virginia Section A.W.W.A. Sec'y-Treas., W. H. Shewbridge, 708 State Office Bldg., Richmond, Va.

Nov. 19-21—WASHINGTON, D. C. (Hotel not selected)
Four States Section A.W.W.A. Sec'y-Treas., W. A. Welch, 748 Public Ledger Bldg., Philadelphia, Pa.

MILTON Roy PUMPS



ADD TREATING CHEMICALS IN *Automatically Controlled Volumes*

- **For Precise Control of Treatment**
- **To Conserve Costly Chemicals**
- **For Automatic pH Control**

Milton Roy Pumps are controlled volume metering units designed to inject treating chemicals in volumes as low as 1 pint per hour to as high as 23 g.p.m. per pump valve. Because of the high degree of accuracy of volumetric measure made possible by the exclusive Milton Roy Step-Valve design these pumps are widely applicable for water and waste treatments.

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For further details write for Bulletin 468 and Technical Paper 54 "Electronics in Automatic Chemical Feed Systems." Our catalog No. 146 on Milton Roy Pumps for chemical and high pressure applications is now available. Ask for your copy.

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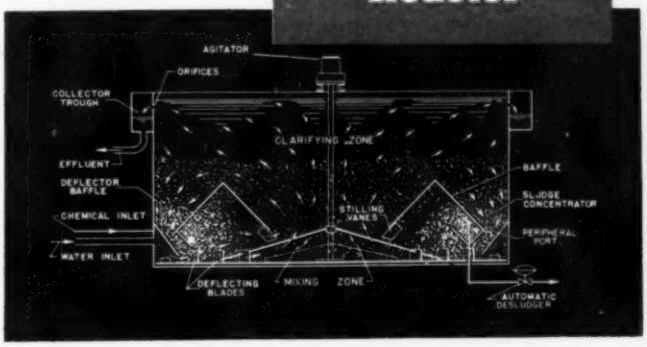
Clearer Soft Water in Less Time

The LIQUON Sludge Contact Reactor



If your water supply requires the removal of hardness, turbidity, color, iron, manganese, silica or fluorides, investigate the LIQUON SLUDGE CONTACT REACTOR.

This highly efficient unit coagulates or softens the water in a fraction of the time required by ordinary mixing and settling tanks, and does so more completely, in less space, and at less cost.

Also, note these important distinctive benefits:

- Cylindrical tank—saving in concrete costs
- All the chemicals are completely utilized
- Clarified water thoroughly separated from the sludge
- No sludge carry-over
- Concentrated sludge discharged automatically

The LIQUON SLUDGE CONTACT REACTOR "stabilizes" the water when used in connection with the cold lime soda process. Write for Bulletin.

LIQUID CONDITIONING CORPORATION

114 East Price Street, Linden, N. J.
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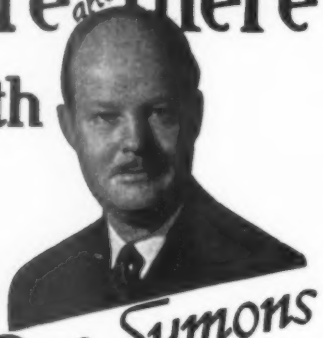
EVERY PROCESS . . EVERY TYPE OF EQUIPMENT
for conditioning of water and other liquids

Here and There with Doc Symons



Well, Well! H. T. M. A.—I suppose by now you have noticed that last month, February, I made the editorial page of this magazine. At least, part of this column appeared where the editorial page should have been and vice versa. Although the editorial page (reader page 80) was intact, the switching, by the printer, of the second page of my column (adv. page 80) with the editor's page did make my review of last year a little hard to follow—or at least harder to follow than usual.

How did it happen?—Well, sir, in this publishing business it is customary to number reader pages consecutively throughout the year and to number advertising pages according to the numerical position in the particular issue. So once each year there are two pages numbered 80, and this time the printer picked the wrong one when making up the reader form. Result—what you found last month when you tried to read this column.

* * *

So help me the following letter was received ten days after the above item was written, and we give it to you unedited.

"Dear Editor: I am sure that many readers of *Water and Sewage Works* recognize the high standard of literary quality in their favorite technical journal. I am not certain that they appreciate the truly unique features which characterize this magazine from time to time. In order to correct this condition, I submit the following:

"TRIBUTE TO A PIONEER.—Doc Symons does the unusual every month—for the extraordinary he requires a little time. Authorities in journalism have long exhorted writers to 'get to the pith of the matter,' but few indeed, are those authors who have succeeded in accomplishing this in a manner so direct and so effective as that originated by Doc in his February column. That column starts not 'Here' on page 80, but 'There' on page 78, which is found no less than four pages *later* in the magazine. Thus, Doc has applied to the writing of articles the 'flash-back' technique which, up to now, has been employed only in novels and motion pictures.

"But Doc is a modest author—it is probable that instead of claiming credit for this accomplishment, he will generously pass it on to the make-up editor or even to the printers (strike, you know). He can, however, take pride and satisfaction, as the father of a new literary pattern, when other columnists follow in his footsteps—there and here. Signed, Harry A. Faber."—Thanks Chum!

* * *

For some time now you've been promised a letter from **John Hood**, Supt. of the Ridgewood, N. J., Sewage Plant. This is not a story of stream pollution but of shore and bathing beach pollution. John and family had gone to the shore for a

DEPENDABLE

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Ferri-Floc
FERRIC SULPHATE
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Ferri-Floc is a superior and economical coagulant developed to provide dependable, low cost treatment of water, sewage, industrial waste and sludge conditions.
Ferri-Floc is a partially hydrated ferric sulphate, a stable, free flowing salt. Granular in shape, it can be fed through any standard dry feeding or liquid feed equipment, and being partially hydrated, it is only mildly hygroscopic. It is easy and safe to handle—does not pass through any gummy stage when going into solution—does not require careful proportioning of water to salt. Ferri-Floc can be shipped in 100 pound bags or in bulk cars and may be stored in open bins for indefinite periods of time. It is most economical and dependable. For complete details, write Tennessee Corporation, Grant Building, Atlanta, Georgia.

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Atlanta, Georgia — Lockland, Ohio

vacation. Wrote John, "When a fellow goes on vacation he expects to avoid all conscious thoughts of his business, but this was my unhappy experience.—While surf bathing, the tide brought in a load of floating debris from a garbage scow dump; then I discovered that the bathing section was near a sewer outfall. And, as if that weren't enough, two days later, when the sea breezes were just right, several floating fish oil factories hove to off shore, cast their nets, made their haul, and processed the catch on the spot. Overboard went the Barnabas (the offal, residue, or gismo to you) which, wafted shoreward by wind and tide, caused a pretty mess on the beach. Aided by Old Sol and millions of multi-hued flies, the inevitable occurred. Result—boardwalk seats went abegging, and ocean fronters wished they had been satisfied with a third floor back. Next night there was a land breeze, and we discovered that the defunct fish weren't half bad compared to smoldering garbage and trash—Talk about pollution—." Well, John, sometimes you just can't win!

* * *

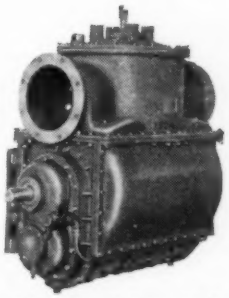
What's in a name? On one of these husband and wife radio programs letters from listeners were being read, and one went as follows: "The initials of the superintendent of our local water works are all WET." That's W. E. Thrasher, the fellow I buy my water from, but, so help me, I did not write the letter.

* * *

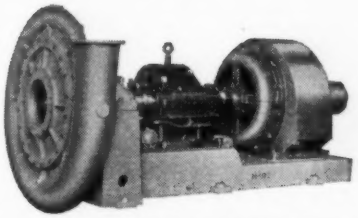
Here's the Proof. At exactly 7:14 a. m. on Dec. 2, 1946, a deer weighing 300 pounds ran past one Francis S. (Fritz) Friel. Friel (Pres., F. S.

W. A.) wasn't quite ready to shoot so early in the morning, but, not wishing to miss out on the first deer

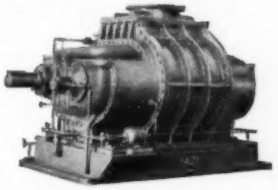
PLUS-VALUE ASSURED



Special design Rotary unit for scavenging Diesel engine

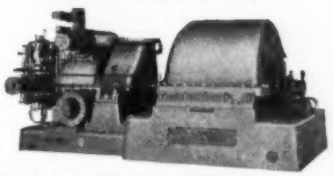


Single-stage Centrifugal Blower

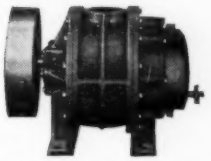


Rotary Positive Gas Pump

Positive Displacement Meter



Multi-stage Centrifugal Blower



Small Rotary Positive Blower for separate or built-in mounting

WITH R-C equipment

You get a plus-value when you bring your air or gas handling equipment problems to Roots-Connersville. That's because of our *dual-ability* to engineer and build either the Centrifugal or Rotary Positive types of Blowers, Exhausters and Boosters. Completely independent thinking permits us to supply exactly the right unit for your needs.

Roots-Connersville also builds Positive Displacement Meters, Liquid and Vacuum Pumps and Inert Gas Generators, in a wide variety of sizes and types. Our long experience assures completely satisfactory performance, resulting from advanced engineering plus precision workmanship.

For intelligent answers to your equipment problems, you can depend upon Roots-Connersville know-how.

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ROTARY CENTRIFUGAL
BLOWER BUILDERS R-C SINCE 1854
BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

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of the season, Fritz grabbed its tail and hung on for "deer" life. After several miles, Fritz was able to maneuver his gun into position and hanging on with one hand shot and clipped the deer on top of the head. Stunned, the deer dropped, and Fritz went around front, grabbed the antlers, and held up his catch. But the deer wasn't through, and then began a "rasslin" match that covered a good many acres, according to witnesses. In the end (front, I'm told), Fritz was able to stab the deer with his trusty hunting knife. When the match was over, the deer had lost 164 pounds, and Fritz himself was somewhat lighter.

This story was officially attested by fourteen others in the party, who were a bit put out at having to chase Fritz all over the county. Proof of the story is shown herewith, and please note that not only was the deer worn to a shadow, but most of his antlers were broken off in the tussle with Fritz.

* * *

I thought I'd seen every possible way for a fellow to get stuck with the check, but at the M. U. W. A. meeting in Portland up pops Reg (Hydro-Tite) Hayes with a new one. This little item is a bottle opener in the shape of a partly clenched fist, with the index finger pointing. Cut from a flat piece of metal with a dimple punched on one side to make a pimple on the other, the gadget can be laid on a smooth surface and caused to spin. Printed on the upper side are the words, "You Pay," and if the finger points to you when it stops spinning—YOU PAY!

* * *

It would be dramatic to say that Don Bloodgood (Prof. of San. Engineering at Purdue), George Martin (Supt. of Sewage Treatment at Green Bay, Wis.), and I were on the same "bag" in the Freshman-Sophomore Bag Rush when we were Frosh at the University of Wisconsin in the Class of '26. Too bad, the story just isn't that dramatic—but we were freshman engineers together. At that time I was probably the only one who had any idea of ending up in the water and sewage works field. If we knew each other then, we had all forgotten it until we got to comparing notes at the Central States meeting last June. We all did remember, however, that there was one girl in our class, the first girl to take Civil Engineering at Wis. She has since become famous for another reason as Emily Hahn, author of "China to Me."—"Slim" Lindbergh was a sophomore when we were freshmen.

* * *

Warning to Future Vice Presidents of A. W. W. A. Don't say I didn't warn you—but when you are traveling to meetings of A. W. W. A. Sections, be mighty sure that your railroad accommodations are O.K., or in the middle of the night Secretary Harry Jordan may have you ousted to make room for him. If you don't believe me, ask Tom Veatch.

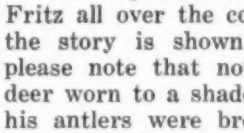
On the way to the Green Bay meeting of the Wis. Sect. last November, Tom Veatch and Tom (C. I. Pipe) Wolfe were comfortably asleep in a drawing room on the train due out of Chicago about 1 a. m. Buzz went their bell about midnight, and the conductor said, "Sorry, boys, but there's another man who has this drawing room for tonight, you'll have to get out." Both Toms would have gladly told off the so-and-so who dispossessed them, but trudged off to lower berths.

I didn't see that midnight parade in pajamas, shoes and hat, clothes over the arm, and bag in hand, but I wouldn't have missed, for anything.

PEERLESS CENTRIFUGAL PUMPS

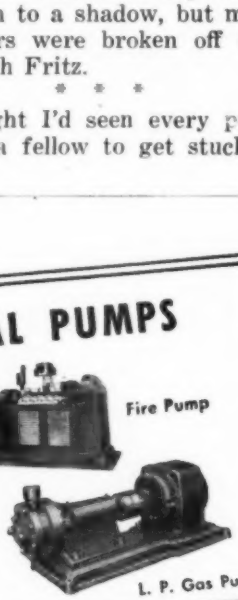
(Formerly Dayton-Dowd)

PEERLESS PUMPS



Fire Pump

Use This Handy Guide to Help You Select the Pump Your Service Requires



L. P. Gas Pump

PUMP	G.P.M.	DRIVE	HEAD OR PRESS.
TYPE "A"	TO 60,000	ALL FORMS	UP TO 300 FT.

Applications: Designed for general service water pumping in a variety of industries. Embodies most advanced design for efficient, continuous duty applications.

TYPE "B"	TO 1,000	ALL FORMS	UP TO 700 LBS.

Applications: Designed particularly for medium capacity, high pressure boiler feed, oil refinery and pipe line service. Multi-stage, split case construction.

TYPE "AF"	TO 2,000	ALL FORMS	UP TO 125 LBS.

Applications: Peerless Fire Pumps (formerly Dayton-Dowd) are the foremost in fire pumps. Embodying latest developments, their selection assures low cost, modern, plant fire protection. Underwriter's approved.

TYPE "CO"	TO 1,000	ALL FORMS	UP TO 200 LBS.

Applications: Especially developed for chemical, refinery, paper mill, food and process industries. Designed to handle acids, black liquors, hot oil, caustics, etc.

TYPE "TU"	TO 2,500	ALL FORMS	UP TO 600 FT.

Applications: For general water pumping services including oil refinery, boiler feed and mining, where development of heads above the range of conventional single stage pumps is desired.

PEERLESS PUMP DIVISION

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seeing their expressions at breakfast next morning when Harry told how he had to have the conductor put a couple of "lugs" out of his drawing room the night before in Chicago.

* * *

At the Feb. meeting of the N. J. Section A. W. W. A. in New Brunswick, the members were crowding the local hotel lobby before going in to lunch. Martin Flentje was talking to another chap near the entrance to the lobby, when a stranger came up and the following conversation ensued:

Stranger—"What's all this gang?"

Flentje—"This is a meeting of the American Water Works Assn."

Stranger—"Yeah? Their stock's going up, too."

* * *

Small World No. 3. I was standing in the Electrical Engr. Bldg. at State College, Penna., waiting for a session of the Penna. Sew. Wks. Operators Assn. to start, when Dick Schatz, Supt. of the Penna. State College Sewage Plant, came up to me and said, "Do you know Hugh Odor?"—I brightened—Hugh Odor had been one of my pals in Decatur when I worked at the sewage plant for "Hap" Hatfield.—It seems that Hugh was in Dick's company in the Southwest Pacific, and knowing that Dick was a sanitary engineer, asked if he knew me.—Small World.

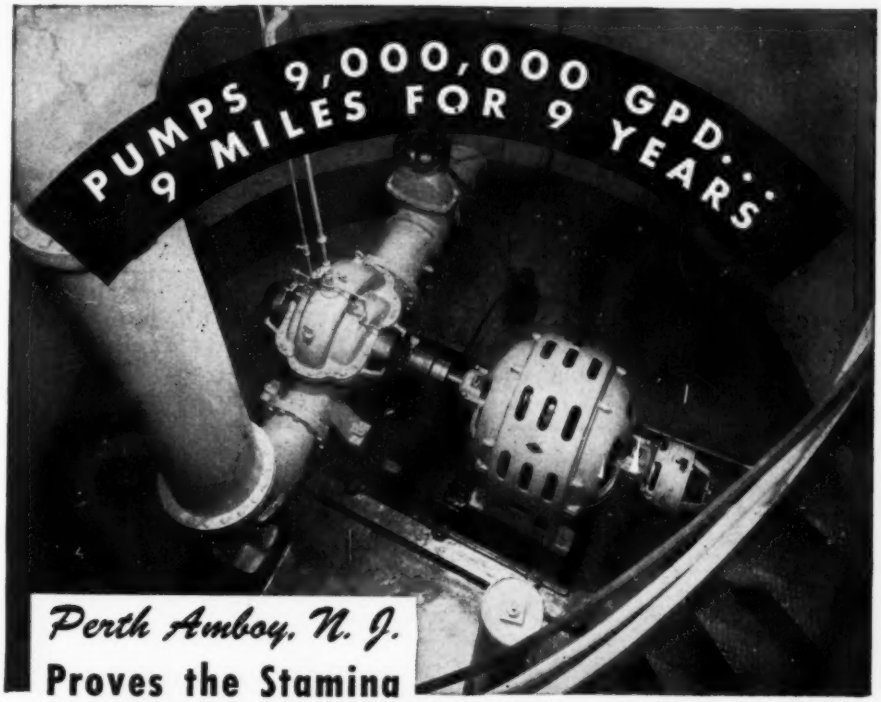
* * *

Do you remember some time ago when I was running a series of malapropisms in connection with water and sewage works? I'm still interested in making a collection of them if my readers can help out. Here's one that L. E. "Wick" Wickersham of Am. Water Wks. & Elec. Co. supplied.

One of their water works properties had sent in several reports on which rather poor coliform index results were recorded. The chemist from the head office wrote to inquire why the B. Coli were so high in the finished water and added, "Don't you worry about it?" Back came the answer, "We're not concerned with B. Coli, it's the bacteria we worry about."

* * *

When L. L. "Hedge" Hedgepeth became Director of the Water Control Commission of Virginia, he immediately uncovered an unusual ground water pollution problem. It seems that a fellow in Arlington County, Va. (that's across the Potomac from Washington, D. C.) had discovered not oil, but high test gasoline in his drinking water well.



Perth Amboy, N. J.
Proves the Stamina of Rugged 8,500 Lb.

MORRIS PUMP

The acceptance test of this Morris Centrifugal Pump showed a delivery of 6,700 GPM at the specified head — an efficiency of 89%, as against the guaranteed 86% efficiency. That was 9 years ago. Since then it has been pumping around 9,000,000 gallons per day, from the Runyon Pumping Station to Perth Amboy, 9 miles away. No major replacements or repairs have been needed during all that time.

THAT shows the value of the Morris policy of building heavy, rugged pumps with conservatively rated bearings and shafts. This particular pump weighs 8,500 pounds. It is direct connected to a 400 HP, 1200 RPM synchronous motor, producing top efficiency at that moderate speed. The suction opening is 16", the discharge opening 14". And it is a *standard* Morris bronze fitted, horizontally split, double suction, single stage pump. Nothing unusual about it except its high, maintained efficiency and long life.

Engineered for the Job

Every Morris Pump is engineered to give the best all-around performance under the conditions at hand. Pumps for municipal water works are built especially for uninterrupted service and long wear . . . and to operate efficiently and economically for long periods, thereby reducing costs in the long run. Morris engineers do not believe in any theoretical 10-year limit to the life of a clear-water pump. Morris Pumps have proved time and again that they can be operated economically and efficiently for many years after this theoretical limit.

Ask for specifications and operation data on pumps to fit your particular needs — based on more than 82 years of Morris pump-building experience.

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
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MORRIS
CENTRIFUGAL PUMPS

Daily the man was pumping 270 gallons of high test gas from his well. Of course, some eleven oil companies in the vicinity were interested in where it was coming from, but the fellow went right on hauling his water from elsewhere and pumping the gas out of his well. At twenty some cents a gallon, he shouldn't have minded at all.

* * *

Sorry, Buffalo Bodie, but that special announcement is still on ice, and anyway there's another story you'll want to hear first. V. T. Y. Doc.

New Pollution Bills Introduced in Congress

Into the legislative hopper of the 80th Congress have gone three more bills for the control of stream pollution, bringing to more than a hundred the total number of bills that have been introduced into Congress within the past 50 years. None has passed to date and one may well wonder what the fate of these new bills will be inasmuch as there still exists a rather wide gulf between the opinions of persons working in the field of sanitary engineering and public health and those interested in conservation of wildlife.

The current water pollution control bills are the Spence (HR 315) and Elston (HR 470), which have identical language, similar for the most part to the Mansfield Bill (HR 6024) of the 79th Congress. The companion bill to the Spence and Elston bills is the Barkley-Taft Bill (S 418), which has been referred to the Senate Committee on Public works.

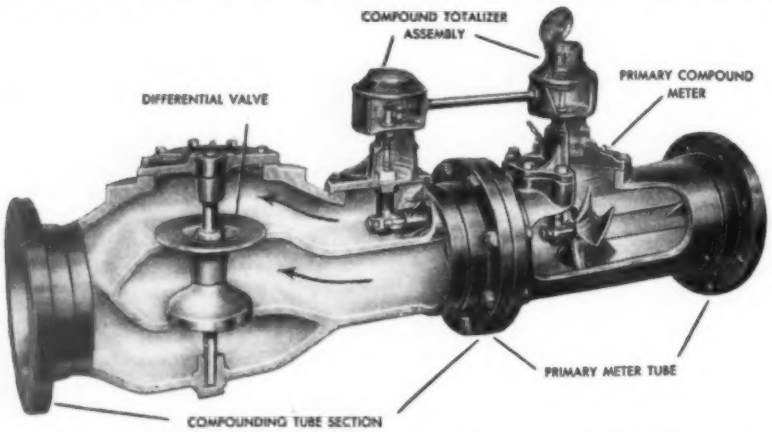
This bill authorizes $100,000,000 per annum for grants-in-aid (not to exceed 33⅓ per cent of the cost) and loans (to bear interest) for the construction of treatment works. $1,500,000 per annum is authorized for grants to States and interstate agencies for promotion, investigations, surveys, etc., in connection with pollution abatement.

Another bill introduced into the House is the Mundt Bill (HR 123), which contains the same wording as the Spence and Elston bills but adds an extra section prohibiting new pollution and making some changes in administration of the act.

The Mundt bill specifically states that "after the enactment of this Act, no new sources of pollution shall be permitted to be discharged into any interstate waters without the approval of the State health authority, made in compliance with regulations prescribed by the Surgeon General." In addition, the bill exempts municipalities and other public bodies from Federal action for five years if the Water Pollution Advisory Board finds it "impossible or impractical for any industry or any municipality or other public body to comply . . . because of financial inability . . . to construct the necessary treatment works or other adequate means of disposal."

Another bill, similar to the "Bailey Bill" of the last Congress, has been introduced by Kee of West Virginia. This bill (HR 1047) is designed to encourage the prevention of stream pollution by allowing amounts paid for the treatment of industrial waste to be deducted in computing net income for tax purposes.

SPARLING MAIN-LINE METERS



Differential valve cracks at about one pound per square inch back pressure from the smaller meter. The smaller meter measures all flows below the minimum accurate range of the larger meter. Both meters drive through ratchet clutches to a common totalizer, which thus operates with the faster turning meter.

The COMPOUND
for Main-Lines up to 36-inch

Now, Sparling accuracy in wider flow-ranges—from 1-60 in 6-inch lines to 1-125 in 36-inch main-lines! And the lowest pressure loss of any Compound—less than 2 pounds psi. Flanged, Bell & Spigot ends.

For prices and flow-ranges see Bulletin 309, free upon request.

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The Postman Can Tell

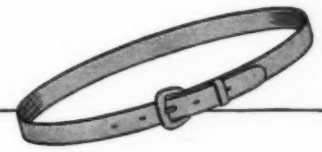
"Well it's plain to see that you must be advertising in WATER & SEWAGE WORKS again."

Procedure for the Handling of Industrial Wastes

On page 37 of the January issue of *Water & Sewage Works* there appeared a staff-authored article on "Special Charges for Industrial Wastes in Municipal Sewage." This article was originally written in July 1946 for the purpose of tying up a few scattered comments on formulas and to point out that such were being effectively used, and further to point out that the modern trend appears to be toward the use of formulas for equitable service rates to industries discharging excessive waste loads from municipal sewage works. The article was not intended to be a complete monograph on the subject of industrial wastes and means for charging for the same in municipal plants. There exists a very excellent report on this subject prepared by the 1945 Committee on Industrial Wastes of the California Sewage Works Association. That report was reprinted on page 503 in the May 1946 issue of *Sewage Works Journal*. It has been called to our attention that a reference to this article was unfortunately omitted in our article appearing in the January issue.

For persons who are faced with the problem of handling industrial wastes in municipalities we heartily recommend a thorough study of that California report. That report includes a survey of methods used in handling industrial wastes, a listing of factors to be evaluated in arriving at a charge or a basis of charge for handling industrial wastes, as well as a discussion of public policy and examples of existing formula or ordinances for charges. In addition, the report includes a thorough discussion of the various factors affecting the following: Chambers of commerce, industrial management, sewage works operations, local government agencies. state agencies, and sanitary engineers and consultants.

In the examples of existing formulae and ordinances for charges, this report lists Buffalo, N. Y., New Brunswick, N. J., and Anaheim and Fullerton, Calif. The report makes the following comment in reference to the first two of these formulae. "In neither the Buffalo nor the New Brunswick formulae is there any consideration given to the many other factors which obtain in different cases as outlined in this chapter. They arbitrarily charge for volume and other constituents with no regard for mitigating influence." While this may be true in some respects with regard to New Brunswick, N. J., the statement is incorrect as far as the formula at Buffalo is concerned. The Buffalo formula is the final result of simplification of a great many of the factors which are listed in the California report. For example, in



Adjustable
TO THE WAISTLINE

Adjustable
TO THE
PIPE LINE

The Dresser Style 60 Bell-Joint Clamp is adjustable to variations in bell and spigot dimensions—makes installation easy and seal completely effective, even on off-size pipe.

High, uniform "pack" all the way around for a *permanently* tight repair on leaking bell-and-spigot joints.

DRESSER BELL-JOINT CLAMPS

ONE OF THE DRESSER INDUSTRIES

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Buffalo the effect of dilution and possible reactions of an industrial waste with sewage during the course of passage through the interceptors is considered and determined by analyses, after which the formula is applied.

A reference to the original article on the Buffalo formula (*Water Works & Sewerage*, March 1944) will indicate that this formula was developed to fit the specific conditions existing at Buffalo where prechlorination, primary treatment, sludge digestion, and sludge dewatering and incineration only are practiced. The Buffalo formula makes no charge for the volume of the waste per se. The rate is based per thousand cubic feet of volume, but is a rate only for chlorine demand and suspended solids above the normal average load existing in the sewage. Inasmuch as the sewer rental system in Buffalo charges according to volume, it was simpler to prepare this formula for charge on the volume basis. In New Brunswick a special charge is made for the volume of industrial wastes, as well as a charge being made for the quantity of solids and quantity of chlorine demand.

Whereas our article in the January issue pointed up three examples of formulas that might serve as a pattern or guide for the thinking of persons interested in this phase of industrial waste treatment, it is suggested that any persons wishing to develop formulas should certainly refer to the California report to obtain information on the background of how best to develop such formulas.

● $200 to $400 revenue is produced by a water meter in a twenty year period.

What are the costs? What is the profit?

Buffalo Meters both American and Niagara, provide high earnings at low cost because of their simple but sturdy construction. First cost is moderate, maintenance cost far below average. Here is part of the reason.

The gear train is cast from a hard, tough alloy of bronze, the gear teeth are machined, to provide rolling action, then coated with a hard shell of chromium to increase wear resistance. The weight of each gear is carried on a patented, dirt-proof, enclosed bearing. Other features such as the extra thick reinforced disc, patented frost bottom and engineered ease of assembly also save maintenance time . . . mean lower cost when repairs are finally needed.

Write for the "specifications" of American and Niagara Water Meters. Strategic design features are illustrated and described.

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Simplicity

Western Penna. Engrs. Seventh Water Conference

Under the chairmanship of H. M. Olson of the Ohio Salt Co., the Seventh Annual Water Conference of the Civil Section of the Engineers' Society of Western Pennsylvania held its meeting in Pittsburgh on January 6, 7 and 8. This meeting had been delayed for some months due to hotel employee strikes. Over 200 persons attended the meeting.

Among the many topics discussed were German synthetic resins possessing exchange properties, potentiometric titration of dissolved oxygen in water, foaming and carryover in boilers, silica deposits in turbines as the result of softening through natural zeolite, silica removal, and iron and manganese removal.

U.S.P.H.S. Grant to Georgia Tech. to Study Water and Sewage Analyses

One of the first non-medical grants by the U. S. Public Health Service has been made through the National Institute of Health to the Georgia School of Technology for a three-year project on fundamental research in water and sewage analysis. About $20,000 has already been made available for the first year's work.

According to Dr. Gerald A. Rosselot, Director of the Georgia Tech Engineering Experiment Station, this project will be conducted in the new sanitary engineering section of the Dept. of Civ. Engr. under the direction of George W. Reid, Assoc. Prof. of San. Engr., who will be assisted by Dr. Robert S. Ingols, Res. Assoc. Prof. of San. Engr., in addition to full-time graduate, and student assistants. Dr. C. E. Renn of Johns Hopkins University will collaborate with Prof. Reid in this research.

Methods developed through this study will make possible better coordination between control tests and the operation of water and sewage

plants and will thus be of importance to every community. As a first contribution, a basic literature search on the entire field is being prepared under the direction of B. H. Weil, Chief of the Georgia Tech Experiment Station's Technical Information Division; copies of this search, when completed, will be made available to government health agencies, universities, and interested industrial groups.

Ed Besselievre Writes Book on Foreign Business

Edmund B. Besselievre, long time representative of the Dorr Company in South America, has written a book titled "Going Abroad for Business." For persons interested in Latin American business or other foreign business, this book is of considerable interest, particularly if a person wishes to prepare himself for possible residence abroad for business purposes.

The book covers such information as the subtleties of alien psychology, pitfalls of local prejudices and protocol, how to call on a government official, when and when not to invite him to dinner, what sort of domestic arrangements to maintain, the social activities of one's wife, and many other similar matters.

Mr. Besselievre acted as advisor and consultant on the preparation of the first issue of *Manual de Ingenieria Sanitaria*, published in 1946 by the Gillette Publishing Company.

Commercial Solvents Co. at Peoria to Recover Waste

C. W. Klassen, Tech. Secy. of Sanitary Water Board, has announced action by the Commercial Solvents Corp. to abate Illinois River pollution resulting from the discharge of distillation residues from the Corporation's plant at Peoria, Ill. This action resulted from a series of studies, conferences and negotiations between the Corporation, the technical personnel of the Greater Peoria Sanitary District, and the State Sanitary Water Board over a period of several years. The wastes result from the manufacture of industrial solvents utilizing corn and molasses as the raw materials in the process.

The installation when completed will recover a valuable livestock feed supplement from the wastes now discharged to the river. It is calculated that the proposed recovery plant will remove waste with a population equivalent of 350,000. The installation will include additional boiler capacity, evaporator, and drying equipment. This installation is the final increment in the stream pollution-abatement program of the Commercial Solvents Corp. and will effect complete recovery of all solids contained in the distillation residues when the plant is operating at capacity production. Approximately twelve months will be required to complete the installation of the equipment.

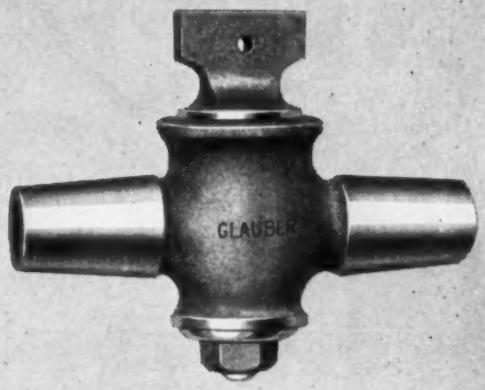
In 1938 the Commercial Solvents Corporation installed a recovery plant for a portion of its process wastes which at that time reduced the population equivalent of the waste by 138,000.

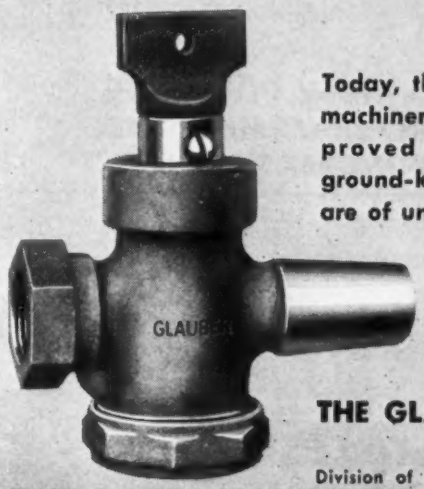
In commenting upon the industrial pollution abatement program of the Illinois Sanitary Water Board, Mr. Klassen pointed out that "while the abatement of stream pollution is the primary objective, promoting the recovery of by-products from waste material has been a definite part of the Board's program, and action by this large corporation is illustrative of the excellent cooperation received from Illinois industry."

Glauber CAN MEET YOUR REQUIREMENTS FOR QUALITY GROUND-KEY CURB STOPS

K1080 — right — Curb stop with solid brass tee handle, round way and lead pipe both ends.

K-1084 — below — Inverted key curb stop with loose tee handle. Round way, inside iron pipe thread to lead pipe.





Today, through the installation of new machinery and the development of improved foundry methods, Glauber ground-key curb and corporation stops are of unsurpassed quality. These same production improvements are stepping up production of all types in an effort to meet current municipal requirements. For quotations write . . .

THE GLAUBER BRASS MFG. CO.
Kinsman, Ohio
Division of H. B. Salter Mfg. Co., Marysville, Ohio

Glauber RED BRASS
GROUND-KEY CURB and CORPORATION STOPS
LEAD GOOSENECKS and WATERWORKS FITTINGS

Iowa State University Revises Engineering Course

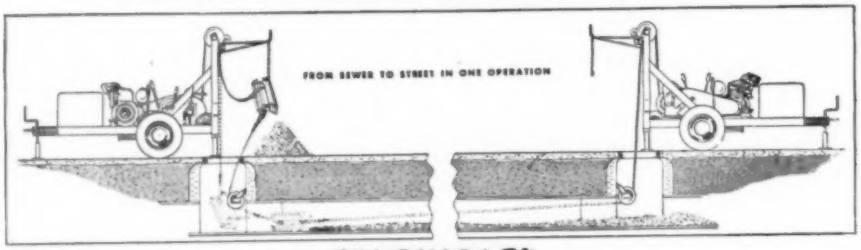
Dean F. M. Dawson of the College of Engineering at State University of Iowa in Iowa City has announced the revision of entrance requirements and the engineering course for that university. The new engineering requirements, which will affect all students entering after next June, will permit an expansion in social science and the humanities during the four year course. The trend is in accordance with the ideas of the American Society for Engineering Education.

The new entering requirements for freshmen are such that it will mean that most students will require at least one semester of work in liberal arts or junior college beyond graduation from high school. The new course at the University of Iowa will include about 25 hours of work in humanities and other non-technical fields. Courses are planned in English, speech, history of engineering, technical writing, economics, political and social science, etc

With the adoption of this new program, future graduates from the University of Iowa should be equipped to offset one of the present criticisms of all engineering and technical graduates, namely, that they have had too little training in writing and speaking.

OVERLOADED SEWERS?

MANY CITIES ARE NOW PLANNING ON CLEANING, TO DETERMINE THE CAPACITY BEFORE INCREASING LINES



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POWER BUCKET MACHINES

Have SPEED, POWER and PORTABILITY,
Special Alloys, Tempering and Bearings

WRITE TODAY—NEW COMPLETE "FLEXIBLE" CATALOG

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Cut Off Water if Garbage Bill Not Paid

In Emporia, Kan., the city is listing water costs and garbage collection fees as one item on monthly bills. This action has been taken to iron out enforcement and bookkeeping wrinkles.

The city commission amended a refuse collection ordinance to eliminate separate billing for garbage disposal work. The garbage fee of 75 cents a month will be added to the amount of the water bill, according to Commissioner Harold Lunsford. Failure to pay the entire bill will be sufficient cause for discontinuing water service.

A Ruined Water Meter Disc

Here is an occurrence that may interest readers who wonder what happens when one puts hot water through a water meter built for cold water.

We found out "accidentally!"

A gas burning water heater in this building caused hot water to back up toward the meter when the hot water was being but little used. The seat of the trouble proved to be that the water temperature was not automatically regulated. When the hot water finally reached the water meter itself things began to happen. The two unions began to leak and steam began to blow out of them. The water was truly "hot."

The leaking and blowing steam finally caused a caretaker to decide that something was wrong and he shut off the gas not knowing what else to do. After that it was found that the water meter wouldn't "work." The disc was warped.

A new disc plus re-gasketing the unions took care of the situation, but, as already stated, we learned what *can* happen to a cold water meter when it gets hot.

Contributed by W. F. Schaphorst, M. E., Newark, N. J.

Indianapolis Water Co. Goes On the Air

The Indianapolis Water Co. has installed the new Urban Mobile Radiotelephone Service and finds it of great help. In one instance, shortly after installation of the service, a maintenance truck at work in one part of the city was able to reach a leaking main in nine minutes after the call was put through. The main

was shut off in short order and repairs started hours sooner than would have been the case before the mobile service.

The transmitter is located on the telephone building and serves an area approximately 25 miles in radius. These mobile phones can call any number in the country and can be called by any phone. Although the mobile phones are reached by shortwave, the frequency of the transmitter (153 megacycles) and auto-units (157 megacycles) are higher than amateur sets and therefore are not subject to eavesdropping.

MANUFACTURERS' and EQUIPMENT NEWS

New Chief Engineers at De Laval

De Laval Steam Turbine Co. of Trenton has announced the recent appointment of Messrs. Harry Engvall, Hans Gartmann, and H. V. Rasmussen to new positions on the engineering staff of the company.

Mr. Engvall, who has been with the company for 23 years, has been appointed Chief Engineer of the Hel-

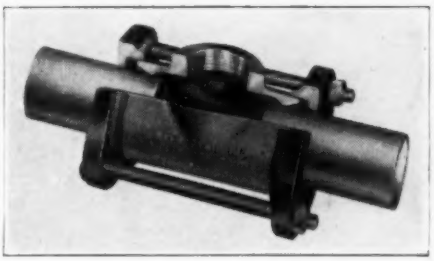
H. Engvall H. Gartmann H. V. Rasmussen

ical Gear Dept.; Mr. Gartmann, who joined the company in 1924, first as a designer of centrifugal pumps and compressors, and later as an hydraulic engineer, has been appointed Chief Engineer of the Centrifugal Pump and Compressor Dept.; Mr. Rasmussen, who joined the company in 1941, having previously been associated with Westinghouse Electric Corp., has been appointed Chief Engineer of the Turbine Dept.

All three men are members of the American Society of Mechanical Engineers.

Flexible Tee Coupling

In the accompanying photograph is shown a new type of flexible tee coupling offering a simplified and more economical way of connecting laterals to existing pipelines. This flexible tee is available for 2 in. cast iron, standard and O.D. pipe, and for other sizes to as small as ¾ in. The design of the coupling eliminates the need for field threading in the trench and does away with flexible couplings, nipples, tees, and unions.



Further information on this coupling may be obtained from the Smith-Blair Co., South San Francisco, Calif.

FOR SEVERE CORROSIVE CONDITIONS...
BITUMASTIC #50 COATS THICK AND TOUGH!
ONE COAT THIS THICK
TWO COATS THIS THICK
THREE COATS THIS THICK

DO YOU WANT IT THICKER?

IF YOU DO, add another coat! There is no limit to the thickness or toughness of the Bitumastic protective sheath you can build up on metal, concrete or masonry where active acids and fumes create a need for unusual measures to combat corrosion.

In spite of its thickness, Bitumastic #50 works easily and is applied readily with a brush. The highly refined coal tar pitch that forms its base is universally accepted as the strongest seal against corrosive action.

There's a data sheet devoted exclusively to the subject of corrosion-proofing for Sewage Disposal Plants—ask for form 342 address Wailes Dove-Hermiston, Westfield, N. J.

GENUINE BITUMASTIC
IS MADE ONLY BY
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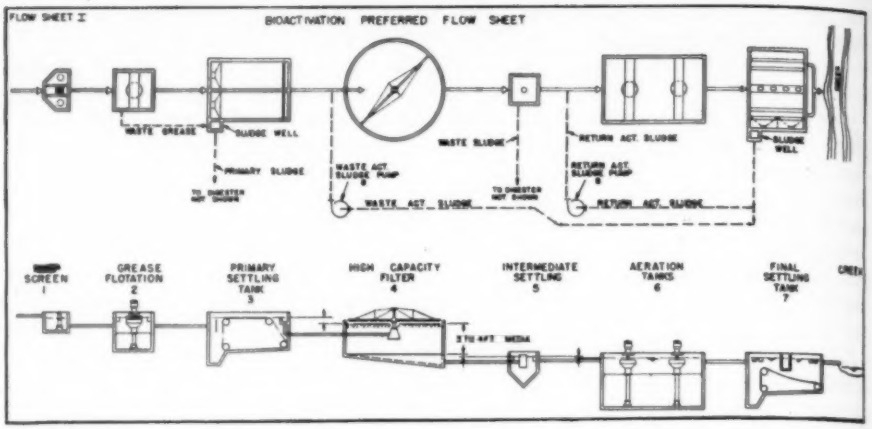
WESTFIELD, NEW JERSEY

"WE'LL SEE YOU AT BOOTHS 56-57
IN THE APRIL 7-10 EXHIBITION OF NACE AT CHICAGO"

"Bio-Activation" Featured by American Well Works

The American Well Works of Aurora, Ill., is featuring a combination biological process of sewage treatment which is termed "Bio-Activation" and represents a combination of the trickling filter and the activated sludge process operating in series with the trickling filter as the first stage and activated sludge as the second stage. The accompanying drawing shows the arrangement of units and represents a flow sheet for the "Bio-Activation" process.



The Bio-Activation process is designed to use the best qualities of both the trickling filter and the activated sludge process, namely, a process which will withstand high shock loads and high strength wastes without upsetting, and at the same time produce a high quality, stable effluent. These processes are combined to work symbiotically in order to obtain the best results. In the Bio-Activation process a small amount of media is used in the trickling filter to obtain the initial high removals of B.O.D. No attempt is made at complete treatment in this unit. The partially oxidized, fresh effluent from the trickling filter is passed into an aeration tank. Under these ideal conditions the activated sludge process is not subject to shock loads or the usual upsets and becomes therefore more dependable.

Further information and design layouts are given in Bulletin No. 259 of the American Well Works, Aurora, Ill.

The Accelator

THE MODERN WATER TREATING PLANT

The widespread acceptance of the ACCELATOR principle of water treatment is due primarily to two basic reasons: First, the exclusive design of the ACCELATOR combines in one compact unit the separate steps of quick mixing, coagulating, settling and sludge removal. It saves up to 80% in space as compared to the older methods. Second, it is a sound, proven principle of water treatment that is being demonstrated daily by hundreds of successful installations throughout the country.

ADVANTAGES
Space Saving
Lower Construction Costs
Longer Filter Runs
Automatic Sludge Removal

The modern, streamlined ACCELATOR water treating process applies the "Know How" gained by INFILCO Inc. engineers from more than half a century of intensive research and development. Ask for ACCELATOR Bulletin 1824. INFILCO Inc., 325 W. 25th Place, Chicago 16, Illinois.

CONSULT INFILCO — FIRST IN WATER AND SEWAGE TREATMENT

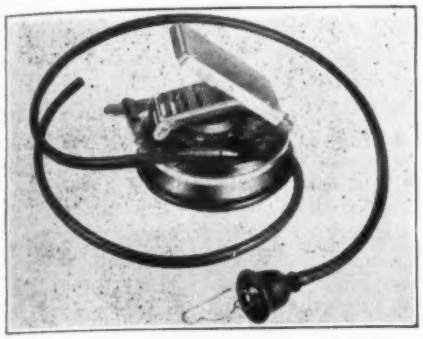
Cooper-Bessemer Announces "Hold-the-Line" Price Policy

Cooper-Bessemer Corp., Mt. Vernon, Ohio and Grove City, Pa., has announced the establishment of a "firm price policy" as a means of holding the price line in connection with the sale of its diesel engines, gas engines, dual fuel engines, and compressors, as well as the purchase of component materials and parts.

This policy was announced by the company because it believes that "only by the establishment of such price policies can industry stop further inflation and get back to sound business practices of free and competitive markets on a firm basis."

A Pocket Filter Plant
(A W-T War Development)

Known as the **Mini-Filter,** a pocket size filter plant weighing less than five pounds has been put on the market by Wallace & Tiernan Co. This device was originally developed during the war and is now being offered for campers, sportsmen, travelers, construction crews or any groups traveling away from approved water supplies.



The device includes a hand pump and filter together with a purifying kit (AQUA-TABS) and the principle of operation is the same as municipal filtration plants. The Mini-Filter which will give protection against water borne diseases will be marketed through sporting goods dealers. For further information address Wallace and Tiernan Co., Belleville, N. J.

New Hydrauger Earth-Boring Tool

A new earth-boring tool, light enough to be operated by one man, has been announced by the Hydrauger Corporation, Ltd. of San Francisco. This item was expressly developed for running in pipe leads. Power is provided by a 3.2 hp. motor

operated by 90 pounds of air pressure. The pilot bit hole is 2 in. in diameter but can be opened up by reaming to 3½ or 4½ in. For easy handling, the boring bar sections are only 2 ft. in length and weigh but five pounds each.

This new development, Model LHH-2, is shown in the accompanying photograph, and further information about it may be obtained from the Hydrauger Corp., Ltd., 116 New Montgomery St., San Francisco.

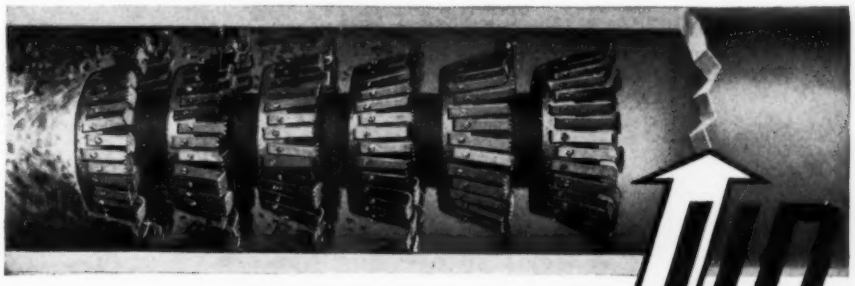
Yeomans Bros. Licensed to Handle Aero-Filter

Announcement has recently been made to the effect that Yeomans Bros. Co. of Chicago has been licensed to promote and sell the Aero-Filter (Halvorson-Smith) process of biological treatment using high capacity trickling filters. The Aero-Filter, of which there are now a number of installations in this country, employs the rain-drop form of application of settled sewage to the entire filter stone surface. It may be obtained in both single stage and multi-stage design.

With the inclusion of this type of equipment in the company's line, Yeomans Bros. now markets all types of sewage treatment equipment from screen, scum, and sludge handling equipment, clarifiers, digesters, sewage pumps and aerators to standard rate distributors.

Yeomans Bros. Co. is located at 1433 N. Dayton St., Chicago 22, Ill.

when
INCRUSTATION
goes out...



...PRESSURE
goes UP

There's no reason to tolerate dirty, incrusted pipe and the resulting reduced pressures, lessened capacity, high pumping costs, dirty water and possible increased fire hazard.

Incrusted and partially clogged mains can be cleaned quickly and effectively with but little or no interruption in service. We guarantee to restore at least 95% of original capacity.

NATIONAL KNOW-HOW PAYS

National methods and equipment have been developed over a period of forty years.

THE NATIONAL WATER MAIN CLEANINIG CO.

50 CHURCH STREET, NEW YORK 7, N. Y.

17 Edgewood Avenue, S. E.
ATLANTA, GA.
1221 Mortgage Guarantee Bldg.
ATLANTA 3, GA.
115 Peterboro St.
BOSTON 15, MASS.
295 West Wacker Drive
CHICAGO 6, ILL.
2518 Grant St.
HOUSTON, TEXAS
P. O. Box 887
WACO, TEXAS
421 B.M.A. Building
KANSAS CITY 8, MO.
448 S. Hill St.
LOS ANGELES, CALIF.
519 Farnsworth Bldg.
MEMPHIS 3, TENN.
3812 Castellar St.
OMAHA 5, NEBRASKA
210 E. Franklin St.
RICHMOND 19, VA.
7103 Dale Avenue
ST. LOUIS 17, MO.
149-151 W. Second South St.
SALT LAKE CITY, UTAH
681 Market St.
SAN FRANCISCO, CAL.
2028 Union Ave.
MONTREAL 2, CANADA
576 Wall St.
WINNIPEG, CANADA
Laurence H. Daniels
P. O. Box 531
HAVANA, CUBA
A. Rodriquez, Inc.
P. O. Box 749
MAYAGUEZ, PORTO RICO
Jorge Triana & Cia
Anartado De Correos No. 5
BOGOTA, COLOMBIA, S.C
J. Vicenti Gutierrez
C. A. Tecnomat, Inc.
Este 2 No. 191-D
CARACAS, VENEZUELA
Carlos Lopez Fuentes
Placa de La Republica 55
Despacho 505
MEXICO, D.F.

W. C. Noyes Retires from Pittsburgh Equitable

W. C. Noyes, the veteran sales engineer of the Pittsburgh Equitable Meter Div. of Rockwell Mfg. Co., resigned at the end of last year. Mr. Noyes first became associated with the old National Meter Co. in 1909. He started working in the Brooklyn factory as an apprentice. His first sales assignment was in the Metropolitan New York area, where he contacted the plumbing trade, and later he was assigned to other districts, including Penna., West Va., and Ohio.

During recent years Mr. Noyes has been attached to the Atlanta office of the company, covering the states of Tennessee and Kentucky.

Rubber Coated Canvas Work Glove

The United States Rubber Co. has started production of a rubber-coated canvas work glove. Produced by dipping the canvas in liquid rubber up to the wrist and then vulcanizing, the final product is a tough waterproof glove that outlasts the ordinary canvas glove. This type of glove should be a great help to persons working about a sewage treatment plant or to crews laying mains or sewers.

Further information on the glove may be obtained from the United States Rubber Co., Providence, R. I.

E. D. Capron Joins Neptune

The Neptune Meter Co. has announced that Edwin D. Capron has joined the sales staff of the company as a sales engineer to represent Neptune in the states of Arkansas and Louisiana.

Mr. Capron is a graduate of Oklahoma A. & M. College and spent 21 months overseas in the European Theatre of operations, where he served as a Staff Sergeant in the Corps of Engineers.

W. G. Boals New Supt. Buffalo Meter Co.

Buffalo Meter Co. of Buffalo, N. Y., has announced the appointment of Walter G. Boals, former general manager of the Rogers Machine Works in Alfred, N. Y., as factory

superintendent of Buffalo Meter. Mr. Boals succeeds E. A. Ritter, former superintendent and longtime executive of the company, who retires on April 1 after 50 years' service with the firm.

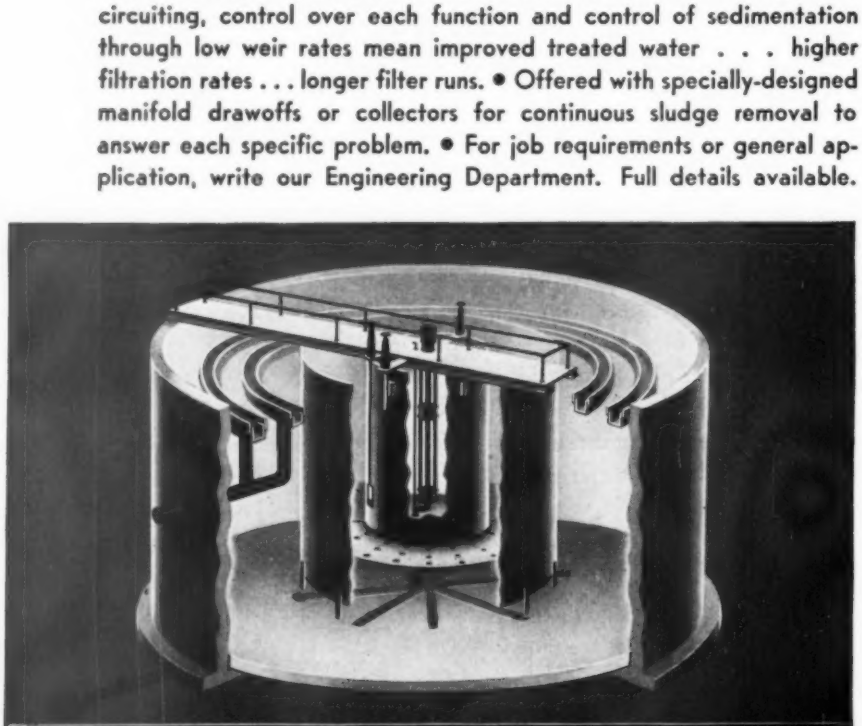
Mr. Boals was plant engineer of the manufacturing division of Dresser Industries, Bradford, Pa., for a number of years.

FOR WATER SOFTENING...TURBIDITY AND COLOR REMOVAL

The PROQUIP Clariflow Unit

With independently-operated mixing, flocculation, stilling and sedimentation zones

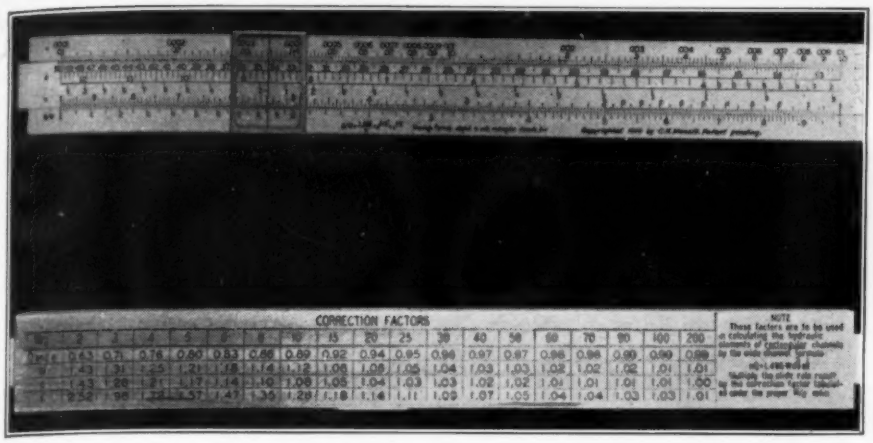
● A notable improvement over conventional short-retention water treatment units. Provides individual functioning of mixing, flocculation, stilling and sedimentation zones. Combines this positive advantage with hydraulic design that's greatly improved over that of conventional vertical flow, short-retention units. • Its control over short-circuiting, control over each function and control of sedimentation through low weir rates mean improved treated water . . . higher filtration rates . . . longer filter runs. • Offered with specially-designed manifold drawoffs or collectors for continuous sludge removal to answer each specific problem. • For job requirements or general application, write our Engineering Department. Full details available.



PROQUIP

WALKER PROCESS EQUIPMENT INC.
EQUIPMENT ENGINEERS
Engineering Offices and Laboratories, AURORA, ILLINOIS

Open Channel Hydraulic Slide Rule



A slide rule to fill the needs of the hydraulic engineer is the new Manning Formula Slide Rule for Open Channel Flow Calculations. This rule, together with a booklet of graphs, is a means of obtaining a direct solution of the unknown factor necessary to solve open channel design problems.

This slide rule has the additional advantage of being an instrument that can be used for arithmetical computations the same as any ordinary slide rule, besides having the scales that solve the adaptation of the Manning Formula. The n-scale of the slide rule corresponds to the C_1 scale on a Mannheim rule and the Q/W scale corresponds to the D scale. The upper scale is the A scale of the standard rule.

The original purpose of the rule was to solve problems of wide channel river flow where the ratio of the width of the channel to the mean depth was over fifty to one. Later the correction graphs were developed so that the rule could be applied to a large range of problems from the farmer's irrigation ditch to the channels of rivers as large as the Colorado.

This short cut tool for hydraulic engineers may be obtained from its designer C. Harry Monett, 300 So. Carmelina Ave., Brentwood Heights, Los Angeles, Calif.

Hagan Corp. Purchases Ring-Balance Instrument Co.

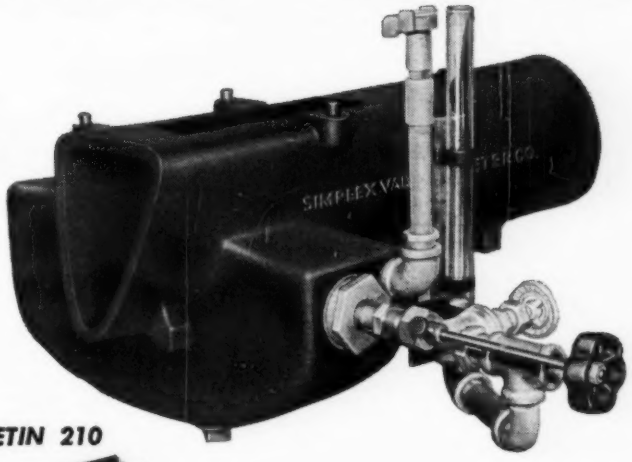
The Hagan Corporation, the parent organization of Hall Laboratories Buromin Co., and Calgon, Inc., has purchased the Ring-Balance Instrument Co. of Chicago. The Ring-Balance Co. has for several years specialized in manufacturing recording, indicating and totallizing meters for the measurement of steam, liquids and gases.

Hardinge Heads York Manufacturers' Assn.

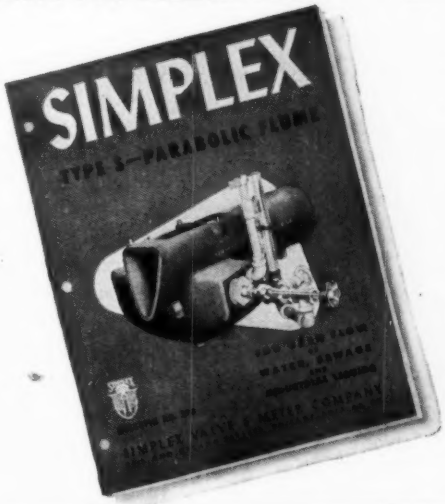
Harlow Hardinge, president of Hardinge Co., Inc., of York, Penna., has been elected president of the Manufacturers' Association of York. York, Penna., is a community of 92,000 persons, most of whom are engaged in manufacturing work for the more than 200 separate industries ranging in size from several dozen to 5000 employees.

SIMPLEX

TYPE-S PARABOLIC FLUME



WRITE FOR BULLETIN 210



For open flow of water, sewage, and industrial liquids

WRITE TODAY FOR YOUR COPY OF SIMPLEX BULLETIN 210—describing the operation, installation and capacity of the new SIMPLEX Type-S Parabolic flume. Contains necessary detailed data for design and specification purposes. Address inquiries to Dept. 213.

SIMPLEX VALVE & METER COMPANY
68th AND UPLAND STREETS, PHILADELPHIA 42, PA.

Milton Roy Pumps Have Improved Stroke Adjustment

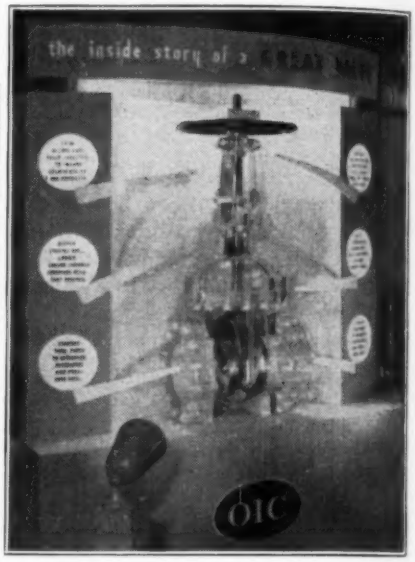
The Milton Roy Company has announced an improved type stroke adjustment for regulating the volume of liquid pumped, during pumping. The micro-indicating adjustment is now supplied as original equipment on standard Milton Roy Chemical Pumps. It provides precise control of the plunger stroke by means of a hand wheel, and a vernier dial permits quick and convenient resetting to any pre-determined stroke length, to within 1/750 of the full length of the full stroke without stopping the pump. This new improved stroke adjustment is fully described in catalog No. 146 by Milton Roy Company, 1329 E. Mermaid Ave., Philadelphia 18, Pa.

J. A. Cuneo FM Los Angeles Branch Mgr.

Fairbanks, Morse & Co. of Chicago recently announced the appointment of John A. Cuneo as manager of the company's Los Angeles branch. Mr. Cuneo succeeds Harry W. Brown (retired) and has been with the company since 1929 as a field engineer representing the company's Export Division. Later Mr. Cuneo was in the Scale Division in Chicago, of which he became manager at the St. Louis branch, and in recent years he has been assistant manager of the Export Division in New York.

Ohio Injector's Unique Transparent Display Valve

The "inside story" of the OIC steel gate valve made by the Ohio Injector Co., Wadsworth, Ohio, is



now being told in display exhibits by a huge transparent plastic valve. The gate valve can be opened and closed readily, to show all of the working parts and their operation.

Hartman to Represent Clay Sewer Pipe Assn. in Ohio

The Clay Sewer Pipe Assn. has announced the appointment of Edward W. Hartman, of Akron, as District Representative for the Ohio Area of the association. Mr. Hartman has

formerly been associated with the Ohio Highway Department and has been Transportation Consultant to the Mexican Government, Senior Engineer for the Rubber Development Corp. in Brazil, and Constr. Engr. for the Firestone Corp. in Liberia.

Mr. Hartman will be located in the main office of the association in Columbus, Ohio.

PROFIT BAGGING with the ROYER SLUDGE DISINTEGRATOR

• Bag Royerated Sludge For Sale to Growing Market
• Royerating For Sale Costs Less Than Disposal

Bagging profits with a Royer at the Madison Metropolitan Sewage Disposal Plant, Madison, Wis.

Burning or burying sewage sludge costs money—converting it to fertilizer with a Royer Sludge Disintegrator costs less. Give your Royerated sludge away and be money ahead—sell it and it spells PROFITS for modern sewage plants. Just shovel in sludge from drying beds—the Royer shreds, removes trash, reduces moisture content, aerates, and discharges finished, salable product direct to bag, pile or truck. Get the results of extensive research—send for free "Sewage Sludge Datalog."

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.

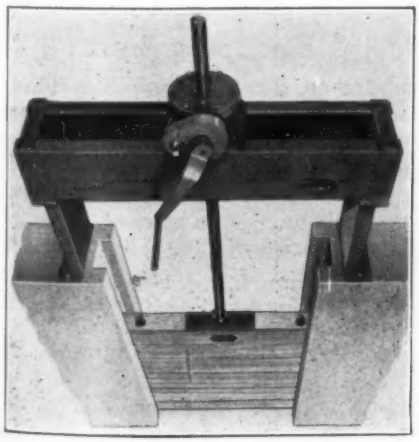
George Kelsey Now a Vice Pres. Builders Iron Foundry

According to a recent announcement from Builders Iron Foundry of Providence, R. I., George W. Kelsey, a Director and Gen. Sales Manager of the company for the past several years, has been named as a Vice President of the company. Mr. Kelsey is also identified with three Builders Iron Foundry subsidiaries. He is Vice Pres. and Gen. Sales Manager of Builders-Providence, Secretary of the Omega Machine Co., and Vice Pres. of Builders-Pacific, Inc., distributors in California.

A graduate of Stevens Institute of Technology, Mr. Kelsey is a member of A. S. M. E. At one time he was Associate Professor in charge of University Extension Courses in Industrial Administration at Rutgers University, and came to Builders Iron Foundry in 1938 from U. S. Steel Corp.

Rodney Hunt Self Contained Gate

Rodney Hunt Machine Co. has a simple wood gate and control that may be easily installed. This gate is positive, self-locking, and easily operated either by hand or electric motor.



For further information write to the Water Controlling Apparatus Division of the Rodney Hunt Machine Co., Orange, Mass.

Westinghouse to Operate Joshua Hendy Iron Works

Westinghouse Electric Corp. has entered a 10-year lease arrangement to take over the operation of the Sunnyvale Calif. plant of the Joshua Hendy Iron Works. An option to purchase the plant at the end of that time is included in the arrangement.

The 57-acre plant will be operated under the direction of Harry F. Boe, Vice president in charge of the Westinghouse Manufacturing and Repair Division. In addition to carrying on Joshua Hendy's present production of pipe line valves and small types of steam turbines, Westinghouse will introduce a number of other Westinghouse products.

New Transparent Waterproofing

The Missouri Damp and Waterproofing Co. has introduced a new transparent waterproofing. Known as Missouri Transparent Wall Seal, the material is low priced and may be obtained in gallon or five gallon cans from the manufacturer, Box 2717, St. Louis 4, Mo.

FORGET IT!!

YES, we mean just that: Forget it! Forget the Rensselaer Gate Valve, or Hydrant, that you install today. Forget it for many years to come.

Isn't that what you want in a Valve or Hydrant: the assurance that it *can* be forgotten? When you buy Rensselaer, you buy more than just another valve; you also buy an assurance of long - term, trouble-free service.

There are many worries you *can't* avoid; why not minimize the ones you can?

RENSSELAER VALVE CO.

TROY, N. Y.

84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

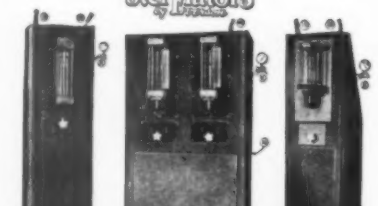
Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

FEED-METERS-MIXES
CHLORINE GAS ACCURATELY

SterElators by Everson



PURIFICATION FOR WATER-SEWAGE & SWIMMING POOLS

Everson SterElators Operate Manually or Semi-Automatically, Also Automatically Proportion Gas Flow to Water Flow.

Everson SterElators Utilize a 24" Water Gauge Vacuum and Visible Flow Meters, with Wide Ratio Ranges of Capacities: 10 to 1, 50 to 1, 110 to 1.

All SterElators Are Dependable, Accurate, Safe and Easy to Operate. Guaranteed to Give Complete Satisfaction.

SterElators by Everson

EVERSON MFG. CO.

233 W. Huron Street
Chicago 10, Ill., U. S. A.

FINE SCREENS
FOR
SEWAGE
AND
INDUSTRIAL WASTES
TREATMENT

FORMER CONCEPTIONS
COMPLETELY OUTMODED

NO COSTLY, POWER CONSUMING REVOLVING BRUSH ARMS—25% GREATER SUBMERGED AREA.

NEW SCREEN PLATES FOR THE ECONOMICAL USE OF A FILTER MEDIA ON THE SCREEN, THUS INSURING GREATER REMOVALS THAN POSSIBLE HITHERTO.

COMPLETELY AUTOMATIC CONTROL POSITIVE SEAL RINGS.

MODERN DESIGN
HIGHEST EFFICIENCIES
LOWEST COST

SANEQUIPMENT ENGINEERING
2943 WHITEWOOD AVE.
ANN ARBOR, MICHIGAN

DESIGNERS — CONSULTANTS

Fred Gibbs Organizes Engineering Sales Corp.

Newest Manufacturers' Agents in New England

On the first of the year, Fred S. Gibbs, C. Hugo Bergman, J. Edward Fitzgerald, and Miss Alice R. Johnson, formerly of the New England Office of Wallace and Tiernan, formed a new corporation known as the Engineering Sales Corp. of Boston. Mr. Gibbs is President of the new company. To be known as

Fred S. Gibbs

"ENSACO", the new corporation has been established to represent equipment manufacturers and will offer sales engineering service to consulting engineers and their clients.

The new Engineering Sales Corp. will be exclusive representative for the Liquid Conditioning Corp. handling mixing, flocculation, clarification, filtration, softening, ion exchange, demineralization, and other water treatments. "ENSACO" will also represent the Ross Valve Mfg. Co., The Hardinge Co., and Hydraugers in New England and expects soon to announce representation of other modern equipment in the field of water treatment.

Electronic Brain

Motron, the Electronic Servomechanism, may be your answer to the problem of automatic control or regulation of a large variety of practical problems formerly needing human supervision. Containing several miniature vacuum tubes, direct control of the speed and direction of a standard 1/15 hp. induction motor may be obtained according to the setting of an input-dial. The input-dial is mounted on selected precision instrument ball bearings and may be rotated by extremely small forces, such as electrical meter movements, pressure gages, flow gages, etc.

Further information may be obtained from W. C. Robinette Co., 802 Fair Oaks Ave., South Pasadena, Calif.

Clay Sewer Pipe Assn. Opens Saginaw, Mich., Office

C. J. Bauer, Jr., Distr. Engr. of the Clay Sewer Pipe Assoc., and its Michigan representative for the past six years, has opened a new office for the association at 117 W. Genesee Ave., Saginaw, Mich.

Horace P. Clark of Mattoon, Ill., Dies

Horace P. Clark, Pres. and Gen. Mgr. of the H. W. Clark Co., Mattoon, Ill., died on February 7, following an acute attack of food poisoning. A native of Mattoon, Mr. Clark had studied mechanical engineering at the Univ. of Wisconsin, and later became a salesman for the H. W. Clark Co., of which his father was president, and in 1944 became president of the company.

Mr. Clark was a member of the AWWA, American Foundryman's Assoc., and many local organizations.

Royer Heads U. S. Chemical Stoneware Sales

The appointment of Hubert Royer as sales manager of the Chemical Stoneware Div. of The U. S. Stone-

ware Co. has been announced recently. Mr. Royer comes to the U. S. Stoneware from General Ceramics & Steatite Corp. He will be located in the New York office of U. S. Stoneware Co. at 60 East 42nd St.

Snake Bite Kit

Mine Safety Appliances Co. has announced a new plastic snake-bite kit which provides rapid, dependable emergency snake bite treatment for workers in snake infested areas. The kit is light in weight, small and compact, and is equipped with a special self-suction pump and all appurtenances for scientific methods of removing the venom of snake bite.

Further information about the M. S. A. Snake Bite Kit may be found in bulletin No. FA-96, obtainable from Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.

CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

"GUNITE" SAVES SEWER IN CANADA

The pictures tell the story. A six-months old concrete pipe sewer line at Owen Sound, Ontario, was found to be failing under earth load. The tests shown above were made and convinced the city officials that a reinforced "GUNITE" lining would correct the trouble, and we did the job in 1934. The sewer was 36" and 48" diameters and one-half mile long.

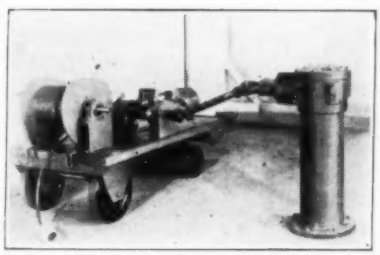
"GUNITE" is ideal for lining and strengthening old brick or concrete sewers and has been widely used for this purpose.

Our 72-page bulletin C2300 describes scores of profitable uses of "GUNITE." Write for your free copy.

MANUFACTURERS OF THE "CEMENT GUN"

PAYNE DEAN GATE OPERATOR

ONLY TWO MEN TO OPERATE YOUR LARGEST GATES. CUTS OPERATING TIME 80%—NO BREAKAGE OF PARTS—FITS ONTO YOUR EXISTING TRUCK—FOR OPERATING GATES FROM 12" TO 60".



PORTABLE MOTOR OR GASOLINE OPERATOR FOR FLOOR STAND OPERATED SLUICE GATES AND UNDERGROUND GATES.

PAYNE DEAN & CO., MADISON, CONN.

GOLDEN-ANDERSON

Design and Build

OVER 1500

TYPES AND SIZES IN

AUTOMATIC

VALVES

For Engineered Protection

on any HIGH PRESSURE

INSTALLATION

● Make Golden-Anderson Valves your first choice on any new or replacement project—for maximum safety, dependability and protection.

Descriptive Technical Catalog on request.

GA

GOLDEN-ANDERSON VALVE Specialty Company PITTSBURGH 22, PA.

LITERATURE AND CATALOGS

Ground Key Work

In an eighteen page bulletin titled **Glauber Ground Key Work,** the Glauber Brass Mfg. Co. presents a complete line of ground key stops, drains, hydrant stops and drains, curb stops, corporation stops, and lead flange corporation stops. Also included are couplings, soldering nipples, water meter union couplings, brass main plugs, lead flange couplings, and tools and parts for the Glauber tapping machine. In addition the bulletin shows Glauber copper service pipe ground key stops, curb stops, couplings and fittings. The completeness of the line is indicated by the illustration of 62 different items.

These ground key stops have full opening waterways, bodies of extra heavy metal, specially designed by-pass which is on the pressure end thereby reducing liability to leakage under the higher pressures, and so constructed that sand, dirt, or sediment can not come in contact with the water tight bearing. All Glauber ground key work features a mechanically perfect taper and water-tight bearing. Handles are of malleable iron. All stops are tested to 200 psi.

This catalog on Ground Key Work may be obtained by writing Glauber Brass Mfg. Co., Kinsman, Ohio.

Diatomaceous Earth Filter

%Proportioneers, Inc.% of Providence, R. I., has issued bulletin No. 1550 on **Diatomaceous Earth Pur-O-Cel Pressure Filters.** The bulletin contains the history of diatomaceous earth, and the story of the development of the diatomite filters during the war for the production of potable water in outlying camps and battlefields.

Also included in the book is a diagram of the Pur-O-Cel Filter itself and a description of the process of operation, including a discussion of the precoat, backwashing and filling. In addition to use for water filtration, the filters are available for industrial processes, oil removal from condensate water, etc. Diatomaceous Earth Slurry Feeders are shown in the bulletin, and construction details also given.

Leopold

● GLAZED FIRE CLAY TILE FILTER

Non-corrosive, permanent.

● DRY CHEMICAL FEEDERS

Compact, light in weight, durable, accurate. Sizes and capacities to suit any operating requirements.

● COMPLETE WATER TREATMENT AND FILTER PLANT EQUIPMENT

Designed and built by Leopold engineers to handle any service.

Write today for complete information.

F. B. LEOPOLD CO., INC.

422 FIRST AVE. PITTSBURGH 19, PA.

No caulking . . . no need to dig large bell holes . . . . large savings

Haymanite

THE PERMANENT, SELF-SEALING JOINTING COMPOUND FOR BELL AND SPIGOT CAST IRON WATER MAINS

FREE ILLUSTRATED BULLETIN

Explains: how Haymanite reduces labor and material costs; how any workman can make permanently tight joints; how fewer tools are needed; how leaks are reduced; why vibration is no threat.

Producers also of M. H. Brand Caulking Lead

MICHAEL HAYMAN & CO., INCORPORATED ESTABLISHED 1869 870 EAST FERRY ST. BUFFALO, N. Y.

FOR BETTER

pH Control

and WATER TESTS

there is nothing like

NON-FADING GLASS COLOR STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

HELLIGE INCORPORATED

3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.

HEADQUARTERS FOR COLORIMETRIC APPARATUS

LOW COST DEMINERALIZED WATER

WILL REPLACE EXPENSIVE DISTILLED WATER IN THE MAJORITY OF APPLICATIONS

★ Demineralized Water suitable for many requirements demanding distilled water, can now be obtained at a fractional part of the cost of distillation. Belco deliveries are surprisingly rapid.

MODERNIZE YOUR ZEOLITE WATER SOFTENERS

The new Belco zeolite will increase the capacity of industrial softeners up to six times as much. Ideally suited for modernization of present equipment. Belco engineers are always available to help you.

BELCO INDUSTRIAL EQUIPMENT DIVISION

50 IOWA AVENUE
PATERSON 3,
NEW JERSEY

CHECK WITH BELCO...first!

Belco

INDUSTRIAL PROCESSING EQUIPMENT SINCE 1892

Bulletin No. 1550 may be obtained by writing %Proportioneers, Inc.% 9 Codding St., Providence 1, R. I.

Foxboro's Flow Meter Handbook

Principles and Practice of Flow Meter Engineering, published by Foxboro Meter Co. and now in its sixth edition, has reached a total of 18,000 copies sold. Do you have your copy? If not, write to The Foxboro Co., Foxboro, Mass.

Safety Manual

The National Safety Council has released its new **Accident Prevention Manual for Industrial Operations.** The 544-page manual contains 400 illustrations, charts, and tabulations, and is intended as a handy and authoritative source of accident prevention information for safety directors, engineers, and foremen. It is divided into 14 major divisions, each one being preceded by a summarizing index for quick location of general topics. A 12-page detailed alphabetical index is included in the book.

Although prepared primarily for the manufacturing industry, much of the information is applicable to non-manufacturing industries and water and sewage works might well be included in this category.

The 14 major subjects covered include plant design and layout, construction and demolition, permanent equipment and facilities, guarding and operating machinery, materials handling and storage, electrical hazards, chemical hazards, fire and explosion hazards, flammable liquids, hand and portable power tools, commercial vehicle operation, personal protective equipment, industrial hygiene, and safety organizations and programs.

The manual is available to both members and non-members of the National Safety Council, from which it may be obtained by writing to the Council at 20 North Wacker Drive, Chicago 6, Ill.

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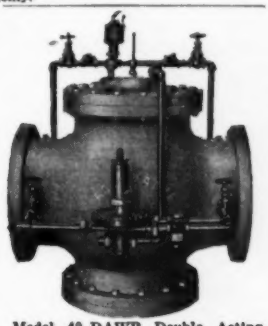
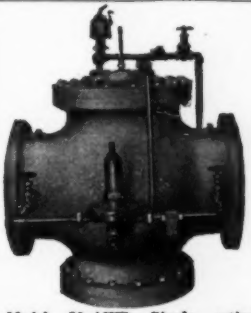
Altitude Valves for tank and reservoir, with two sets of controls—Automatic Hydraulic and Electric Remote Control. Hydraulic pilot normally operates the valve, while electric pilot is used for emergency only.



Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require direct pumpage.



Model 30-AWR Single acting valve may be controlled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

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Portable Generators

In a four-page folder, **Homelite Portable Generators** are shown in their adaptability to produce portable power for any job. Five different models of various weights, sizes and power production are shown, as are pictures of typical uses of these portable generators. Also shown is a cutaway drawing of the Homelite generator.

A copy of this bulletin may be obtained from Homelite Corp., Port Chester, N. Y.

Residual Chlorine Determination

In two Technical Publications 4C and 6C, Wallace and Tiernan have presented two new devices for determining residual chlorine. These are the **Amperometric Titrator** (T. P. 4C) and the **Orthotolidine-Arsenite Chlorine Comparator** (T. P. 6C).

The former device permits of actual titration (using an electrometric endpoint) of both free available chlorine and chloramine residual either separately or in the same sample. The bulletin describes the construction and operation of the amperometric titrator.

The orthotolidine-arsenite chlorine comparator is as its name indicates a device for determining both free residual chlorine and combined residual chlorine by the orthotolidine-arsenite method. The four page bulletin describes the construction and operation of the device and a cut-away diagram shows the principle of operation. A standard chlorine color disc is used with the apparatus as the basis of comparison of color. The device may also be used for determining pH by substituting the desired pH color disc in the apparatus.

Either or both of these technical publications may be obtained by writing Wallace and Tiernan, Newark 1, N. J.

Induction Motors

Publication No. 188 is a die cut four-page folder in the shape of a motor and showing cutaway views and details of construction of the new **E-M Heavy-Duty, Squirrel-Cage Induction Motors.** These motors are designed for drip-and splash-proof construction in large power ratings from 100 to 1000 hp., 1800 rpm. and lower. This publication may be obtained by writing Electric Machinery Mfg. Co., Minneapolis 13, Minn.

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Register-Indicator-Recorder

In Bulletin 324-A, Builders-Providence presents the **Type M Register-Indicator-Recorder.** This four-page folder gives a description of the device, features of the Type M, and specifications. Also shown are the various types of installations whether Weirs, Parshall Flumes, Kennison Nozzles, or other flow metering devices used in open channel work for which the Type M Register can be adapted.

Write for Bulletin 324-A to Builders-Providence, Div. of Builders Iron Foundry, Providence 1, R. I.

Pump Engineering Data

Here is a book that really gives you more for your money than the title implies. Published by Economy Pumps, Inc., **Pump Engineering Data** contains more than pertinent information on Economy Pumps.

The book begins with 38 pages of "Principle of Pump Engineering," which is followed by 107 pages of "Engineering Data" and ten pages of "General Information" on pumps. The next 218 pages are devoted to pictures, descriptions, and specifications of eleven different types of pumps developed for different uses. Twenty-eight pages of pump accessories are shown and the index takes up eight pages.

Measuring 8½ by 4¾ in., this book is not only a catalog of Economy Pumps, it is a valuable engineering reference book. It may be obtained for $2.00 per copy from Economy Pumps, Inc., Hamilton, Ohio.

Flowrator Dimensions

Fischer & Porter Co. has combined into a single bulletin a set of certified dimension drawings for series **700 Flowrator.** The book contains no sales information and has been reduced to the handiest possible form, with comprehensive and accurate dimensional information important to the piping layout draftsman. Various types of indicating Flowrator instruments (formerly known as the Rotameter), along with panel mounting arrangements, alarm attachments, transmitters, and recorder-controller accessories are included in the bulletin.

This book is available for limited distribution to all engineers working with the design of piping layouts utilizing flowmeter installations. Copies may be had on request by writing to Fischer & Porter Co., Hatboro, Pa., Dept. 9F-A. Ask for Catalog Section 27-A.

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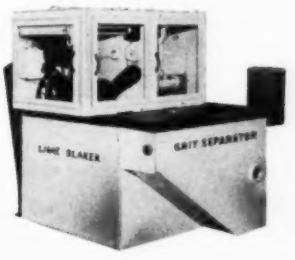

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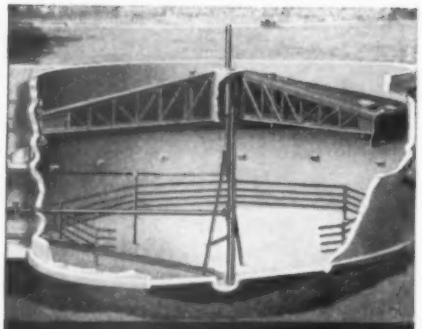

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Residual Chlorine Recorders

Technical Publication 2C of Wallace and Tiernan Co. contains the description and operation principles of a new device known as the **Residual Chlorine Recorder,** Type A-558. This device is a step forward in the control of chlorine dosage in water plants. It makes possible both visual and permanent indications of the amount of residual chlorine existing in a water at all times. The residual chlorine recorder acts as a sentinel to give alarm when the concentration of residual chlorine drops below a predetermined level. The installation, construction, operation, and design features of the device are all described in T. P. 2C which may be obtained by writing Wallace and Tiernan, Newark 1, N. J.

Water Meters

The Exclusive Balanced Oscillating Piston Principle is found in the **Empire Type 12 Water Meters** described in Bulletin No. W-802 of the Pittsburgh Equitable Meter Co. The bulletin contains cutaway drawings of the various parts of the meter, the individual parts, and a diagram of the meter operation. Also shown are means of assembly and the various types of registers available for this type of meter, as well as illustrations of the several parts.

For detailed information on Empire Type 12 Water Meters write to Pittsburgh Equitable Meter Div., Rockwell Manufacturing Co., 400 N. Lexington Ave., Pittsburgh 8, Pa., and ask for Bulletin No. W-802.

Motor Pump

For use with equipment requiring circulating or supply pumps you might try **The Cameron Motor Pump —An Ingersoll-Rand Product,** described in Form 7098, published by that company. This bulletin shows the features of the pump important to equipment manufacturers, its facilities for production, pictures and illustrations of single-stage, two-stage units, and four-stage units. Also shown are a number of illustrations of the application of the pump and manufacturing processes of many kinds. There are immersion type units, horizontal type units, and sidewall mounted units available.

If you have a problem involving circulating liquids, we suggest you write Ingersoll-Rand, Cameron Pump Div., for Form 7098. Address your request to 11 Broadway, New York 4, N. Y.

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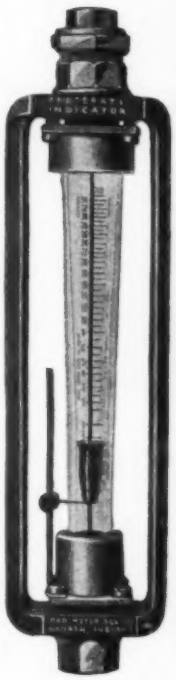

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No. 12

Ion Exchange Softeners

When it comes to softening water and dealkalizing it, the Permutit Co. recommends **Zeo-Karb Water Softeners and Dealkalizers** as shown in Bulletin No. 2418. This bulletin describes Zeo-Karb as the double-duty water softener and dealkalizer, and explains how the system works. The bulletin also shows a typical layout and discusses the operation of the equipment. Also presented are analyses of boiler feedwater treatment and varied industrial applications, as well as photographs showing installations.

Bulletin No. 2418 may be obtained from The Permutit Co., 330 W. 42nd St., New York 18, N. Y.

Check Valves

It takes only a six-page folder to show the **Rensselaer Check Valves.** Bulletin V-1 shows the List 340 Clearway Quiet-Closing Check Valves, the List 37 Standard Swing Check Valves, and the List 370 Quiet-Closing Check Valves.

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This bulletin also contains a description of the List 370 and its eleven points of superiority, as well as a table of dimensions for the List 340 and the List 37 and 370.

Also shown in this bulletin are List 39 Heavy Pressure Check Valves, and pictures of various gate valves, tapping sleeves, floor stands, etc.

Bulletin V-1 may be obtained by writing Rensselaer Valve Co., Troy, N. Y.

Packaged Sewage Pump

The Chicago Pump Co. Sewage Equipment Division has issued Bulletin 122-S entitled **Single "Packaged" Flush-Kleen** in which is described the clog-proof sewage pump for small outlying lift stations requiring 50 gpm. in flow or less.

This bulletin shows a cutaway drawing and a diagram of the "Packaged" Flush-Kleen pump, explains where and how to use it, as well as explaining the automatic backwashing operation of the strainer which keeps the solids from the basin and the pump.

Write for Bulletin 122-S to the Chicago Pump Co., Sewage Equipment Div., 2300 Wolfram St., Chicago, Ill.

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Automatic Temperature Control

The Wheelco Instruments Co. has issued a 20-page "Educational" Bulletin No. 5 on **Automatic Temperature Control Systems.** This bulletin shows the electronic link between measurement and control and presents charts, tables, and diagrams in connection therewith. Also shown are selection of proper control systems for process applications, thermocouples, etc.

Automatic Temperature Control Systems Bulletin No. 5 may be obtained from the Wheelco Instruments Co., 847 W. Harrison St., Chicago 7, Ill.

Oil Circuit Breakers

Not too often do water and sewage works men have occasion to install circuit breakers, but when one does it is well to know where information on such exists. A recent catalog on this subject is a 12-page bulletin issued by the Allis-Chalmers Co. This bulletin numbered 71B6421 describes the **FZO-150 Unitop Oil Circuit Breaker.** The bulletin may be obtained by writing Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

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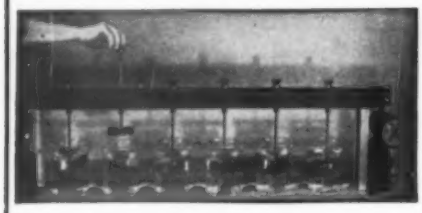

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Submersible Pump

The Pump Division of Byron Jackson Co., Los Angeles, has recently released a 12-page bulletin No. 46-5000 dealing with their deep well turbine pump and electric motor unit known as the **Submersible Pump.** This is a motor pump unit which operates entirely submerged in water at any depth for pumping applications of capacities from 7,000 to 20,000 gpm. and heads up to 1,500 ft.

The bulletin is illustrated with photographs, parts diagrams, and tabular data, and covers specifically Submersible Pumps, Type "B" for relatively low capacities and high head operations, Type "K" for general deep well applications, and Type "R" for relatively high capacities, low head operations. Also illustrated are applications of the pump in a flood area and in other locations.

A copy of Bulletin No. 46-5000 may be obtained by writing to Byron Jackson Co., Box 2017, Terminal Annex, Los Angeles 54, Calif.

Cast Iron Pipe Story

If you want to read an interesting story of how an old time substitute water main material was replaced with cast iron pipe, look in the January '47 issue of **Cast Iron Pipe News.** Therein you will find Harold Londo's intriguing story of the experiences at Green Bay, Wis., where back in the 1880's a "stove pipe" was laid for water mains. Pipe replacement began in 1905 and continued until 1934, when a total of 97,008 ft. of this substitute pipe had been taken out of service and replaced with cast iron pipe.

The *Cast Iron Pipe News* is published by the Cast Iron Pipe Research Association, Peoples Gas Bldg., Chicago 3, Ill.

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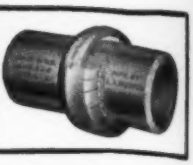

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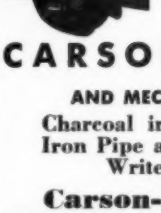

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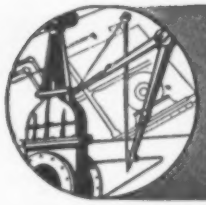

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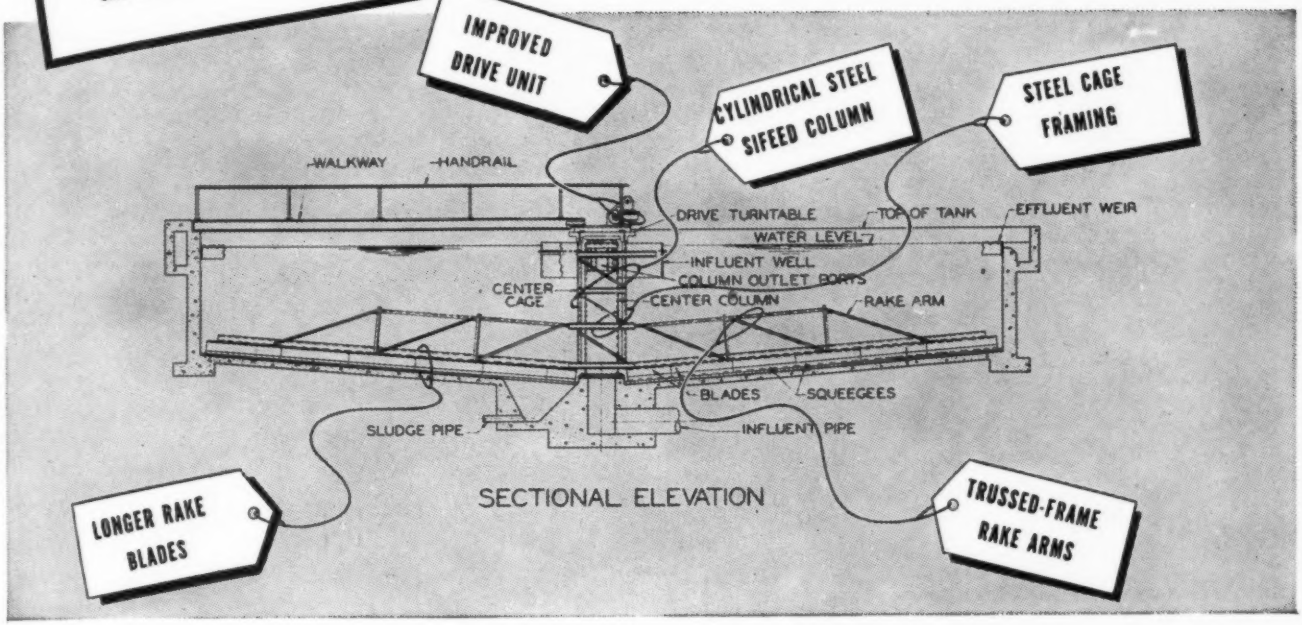

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